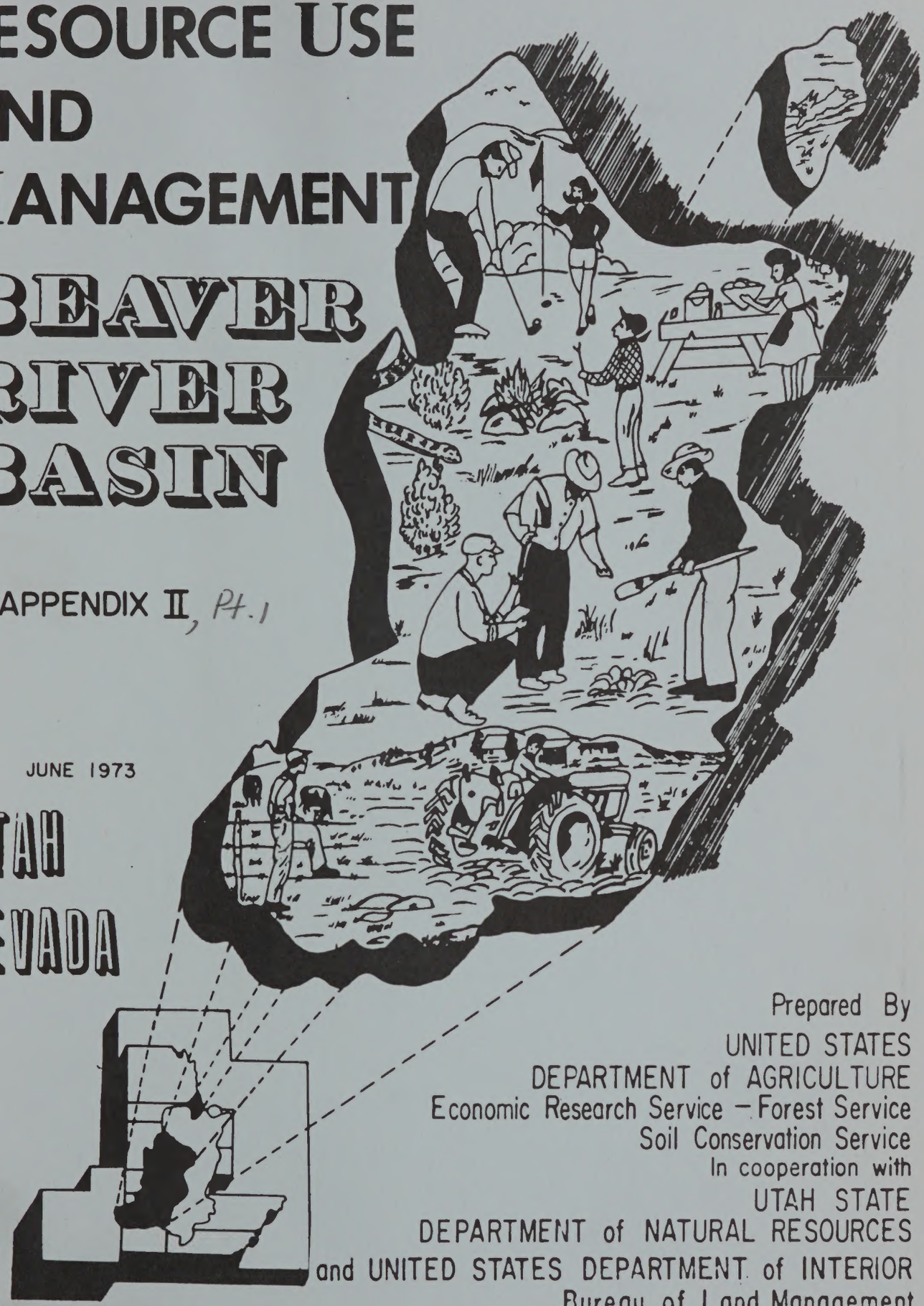
PRESENT AND PROJECTED RESOURCE USE AND MANAGEMENT

BEAVER RIVER BASIN



APPENDIX II, Pt.1

JUNE 1973

UTAH
NEVADA

Prepared By
UNITED STATES
DEPARTMENT of AGRICULTURE
Economic Research Service – Forest Service
Soil Conservation Service
In cooperation with
UTAH STATE
DEPARTMENT of NATURAL RESOURCES
and UNITED STATES DEPARTMENT of INTERIOR
Bureau of Land Management

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APPENDIX II

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The following publications have been prepared under the Beaver River Basin study:

Summary Report	
Appendix I	Natural Resource Inventory Soils Supplement
Appendix II	Present and Projected Resource Use and Management Water Related Land Use Supplement Water Budget Analysis Supplement
Appendix III	Resource Related Problems
Appendix IV	Economic Base and Needs
Appendix V	Potential Development Opportunities Irrigation Systems Supplement

A P P E N D I X II

PRESENT AND PROJECTED RESOURCE USE AND MANAGEMENT

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INTRODUCTION

This appendix describes present and projected use and management of water, land and recreation resources. Water uses described include agricultural, domestic, industrial, and fish and wildlife. Land use and management are described on watersheds, cropland, forested land, grazing, and mining lands. Recreation resources include the many scenic attractions and opportunities present for outdoor recreation, and present and projected levels of recreation activity.

Projections of resource use and management are for the next ten to fifteen years (by 1980 or 1985) that would be accomplished by on-going programs. Results of development opportunities through accelerated or new programs are not presented here, but will be shown in Appendix V. Two supplements to this basic data appendix were prepared: Water Related Land Use and Water Budget Analysis. Only brief summaries of these supplements appear in this appendix.

The Beaver River Basin has abundant resources, but water shortages frequently limit agricultural development of irrigated land. The proper use and management of this limited water resource is critical to the future of the area. Demands upon land resources are also increasing the need for better protection and management.

This appendix is one of five prepared during the study which are listed in the front of this report. Appendix I, "Natural Resource Inventory" and an accompanying Soils Supplement describe the basic resources. The remaining appendixes are Appendix III, "Resource Related Problems"; Appendix IV, "Economic Base and Needs"; and Appendix V, "Potential Development Opportunities". The Summary Report presents a resume of data appearing in these appendixes.

Chapter I

WATER USE AND MANAGEMENT

Water is used by onsite vegetation; for agricultural, domestic, municipal, industrial, wildlife, power, and recreational purposes; and is valued for its scenic enhancement of the environment. Increasing demands for this limited resource cause difficulty in evaluating and incorporating proper values into water management decisions. Consideration must be given to many uses including both consumptive and non-consumptive. Because of the competing demands on water, which cannot all be met, careful coordination is needed in its development and use.

ONSITE WATER USES

The average annual precipitation produces about 4,650,430 acre-feet of water (Table 1). Most of the precipitation is either evaporated or used by vegetation where it falls. In the valley areas and areas that receive less than 12 inches annually, essentially all water is evaporated or used by vegetation although some runoff occurs from cloudburst-type rainstorms and rapid snowmelt. In the mountainous areas where precipitation ranges to 40 inches or more, melting snow and spring rainstorms produce more water than the soil will hold. Water that runs off the surface or passes through the soil beyond the root-zone becomes streamflow, ground water, or is evapoarted from the soil. Vegetation and evaporation on the watersheds consume 4,075,960 acre-feet or about 88 percent of the supply.

Onsite benefits of this consumptive use includes maintaining the vegetative cover of the watersheds that in turn provides many scenic, economic, and social values. Yield from National Forests provides 87 percent of the stream flow to cropland areas (Table 1).

AGRICULTURAL WATER USE AND MANAGEMENT

Because the existing water supply is limited, future development of irrigated land will depend upon more efficient use of this supply, and upon water imported from outside the Basin. Continued application of modern technology, along with on-farm land treatment and structural measures, can increase root-zone supplies through increased irrigation efficiencies.

TABLE 1.--Average annual precipitation, yield to water budget areas, and on-site watershed consumptive use, Beaver River Basin, 1956-1965

Watershed and subbasin		Precipitation			Yield to water budget area			On-site watershed consumptive use[a]
		Water budget area	Non-water budget area	Total	National Forest	Other	Total	
		Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet
2-1	Sevier Lake	-------	745,100	745,100	-------	-------	-------	745,100
2	Sevier Lake	-------	745,100	745,100	-------	-------	-------	745,100
2A-19	Tintic	-------	144,600	144,600	-------	-------	-------	144,600
2A-24	Chalk Creek	56,950	99,210	156,160	23,190	20	23,210	76,000
2A-25	Corn Creek	63,790	217,410	281,200	23,130	90	23,220	194,190
2A	Fillmore	120,740	461,220	581,960	46,320	110	46,430	414,790
2B-1	Beaver	32,410	266,630	299,040	47,300	2,100	49,400	217,230
2B-2	Wildcat Creek	9,200	118,740	127,940	3,360	1,480	4,840	113,900
2B-3	Minersville	29,660	487,180	516,840	3,780	-------	3,780	483,400
2B-4	Milford	3,370	55,260	58,630	-------	-------	-------	55,260
2B-5	Cove Creek	-------	57,200	57,200	-------	-------	-------	57,200
2B-6	Black Rock	710	11,170	11,880	-------	-------	-------	11,170
2B-7	Jacobs Well	-------	250,160	250,160	-------	-------	-------	250,160
2B	Beaver-Milford	75,350	1,246,340	1,321,690	54,440	3,580	58,020	1,188,320
2B1-1	Coal Creek	48,380	223,520	271,900	12,970	3,900	16,870	206,650
2B1-2	Green's Lake	1,410	5,620	7,030	590	180	770	4,850
2B1-3	Red Creek	52,390	233,740	286,130	18,250	3,050	21,300	212,440
2B1-4	Quichipa Creek	24,600	70,060	94,660	10,430	3,130	13,560	56,500
2B1-5	Rush Lake	-------	104,270	104,270	-------	-------	-------	104,270
2B1-6	Other	-------	11,390	11,390	-------	-------	-------	11,390
2B1	Cedar-Parowan	126,780	648,600	775,380	42,240	10,260	52,500	596,100
2B2-1	Pinto Creek	31,010	165,040	196,050	2,550	-------	2,550	162,490
2B2-2	Shoal Creek	11,700	133,820	145,520	3,900	-------	3,900	129,920
2B2-3	Beryl	40,090	456,130	496,220	-------	5,400	5,400	450,730
2B2-4	Big Hollow	-------	380,430	380,430	-------	-------	-------	380,430
2B2-5	Other	-------	8,080	8,080	-------	-------	-------	8,080
2B2	Escalante Desert	82,800	1,143,500	1,226,300	6,450	5,400	11,850	1,131,650
Basin Total		405,670	4,244,760	4,650,430	149,450	19,350	168,800	4,075,960

[a]Non-water budget area precipitation minus total yield.

Second only to evaporation and use by native vegetation, irrigation is the largest water user in the Basin. Annual water budgets were prepared for 1956-1965 except for Escalante Desert subbasin where the years 1958-1965 were used. Approximately 470,940 acres are within the water budget boundaries, including all irrigated land (except for 410 acres in the Sevier Lake and Cove Creek watersheds), all wetlands and miscellaneous land. A water budget analysis was made for twelve budget areas within the basin and is included in the "Water Budget Analysis Supplement" to this appendix. Average annual water supply to the budget areas was 584,090 acre-feet (Table 2).

IRRIGATED CROPS

The potential consumptive use for the Basin averaged 252,500 acre-feet of water annually. Potential consumptive use is the potential evaporation and transpiration by irrigated crops during the entire year, assuming a full water supply.

On areas designated as irrigated land in the water budget analysis, average annual actual consumptive use for the 1956-1965 period was 190,040 acre-feet. The total available supply was 418,730 acre-feet for the same period (Table 3).

Most surface supplies are diverted directly from perennial streams. Monthly and annual streamflows are discussed in Appendix I, "Natural Resources Inventory." Reservoirs, which provide short and long term irrigation storage, are discussed in a later section. Surface water diversions varied from 82,490 acre-feet in 1959 to 271,150 acre-feet in 1958. Fifty percent, or an average of 75,000 acre-feet were diverted during the months of May and June, while only 15 percent of 22,300 acre-feet were diverted during the months of October through March. Most of the winter diversions were not efficiently used.

Total well diversions have continually increased since 1945. For example, total annual diversions in the Beryl-Enterprise area of the Escalante Desert subbasin increased from 7,000 acre-feet in 1945 to a high of 70,900 acre-feet in 1964. Well diversions in the Fillmore subbasin increased from 18,000 acre-feet in 1946 to 58,400 acre-feet in 1963. Well diversions in other areas have not increased as rapidly as the examples shown. During the 1958-1965 period annual well diversions varied from 161,760 acre-feet to 208,310 acre-feet. Pumped wells are used as a supplemental supply to existing surface systems in all but the Beryl area.

Direct use of ground water, where the water table is within the crop root-zone, occurred on 4,900 acres of irrigated crops. This condition is found only in the Beaver Watershed and averaged 11,300 acre-feet of use annually during 1956-1965. Crops receiving a partial direct supply from ground water are limited to irrigated pasture and some alfalfa.

TABLE 2.--Average annual water supply to water budget areas, Beaver River Basin, 1956-1965

Water budget area and subbasin	Yield to water budget areas	Inflow from other watersheds		Precipitation	Total supply
		Ground water	Surface water		
	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet
2A-24 Fillmore	23,210	6,000	1,350[a]	56,950	87,510
2A-25a Meadow	11,980	600	-	25,320	37,900
2A-25b Kanosh	11,240	-	-	38,470	49,710
2A Fillmore	46,430	-	1,350	120,740	168,520[g]
2B-1 Beaver-Greenville	49,400	-	-	32,410	81,810
2B-2 Manderfield	4,840	-	-	9,200	14,040
2B-3,4,6 Minersville-Milford	3,780	2,370[e]	18,640[b]	33,740	58,530
2B Beaver-Milford	58,020	1,070	-	75,350	134,440[g]
2B1-1c,2,4 Cedar	25,430	3,100	6,570[c]	58,100	93,200
2B1-1a,3a Summit	2,920	3,500	-	12,580	19,000
2B1-1b,3b,3C Parowan	24,150	-	-	56,100	80,250
2B1 Cedar-Parowan	52,500	-	6,570[c]	126,780	185,850[g]
2B2-1 Newcastle	2,550	-	1,700[d]	31,010	35,260
2B2-2 Enterprise	3,900	-	-	11,700	15,600
2B2-3 Junction	5,400	5,000[f]	-	40,090	50,490
2B2 Escalante Desert	11,850	1,000	1,700	82,800	97,350[g]
Basin Total	168,800	-	9,620	405,670	584,090[h]

[a] Inflow of Central Utah Canal.

[b] Seepage and releases from Minersville Reservoir.

[c] Groundwater from Markugunt Plateau which reaches the water budget areas as surface flow.

[d] Import through Santa Clara-Pinto transmountain diversion.

[e] Includes 1,070 acre-feet from Escalante Desert

[f] Includes 1,000 acre-feet from Cedar-Parowan subbasin.

[g] Does not include flows within subbasins.

[h] Does not include flows within subbasins.

TABLE 3.--Annual actual consumptive use and available water supplies for irrigated areas, Beaver River Basin, 1956-1965[a]

Subbasin	Item	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1956-1965 average
		Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet
2A Fillmore	Actual consumpitve use	41,080	52,670	46,830	45,730	51,070	53,280	51,950	49,320	55,530	60,260	50,770
	Surface diversiona	25,860	61,080	48,920	18,390	29,660	21,010	48,130	18,590	39,090	44,720	35,540
	Well diversions	34,740	37,290	40,440	47,130	52,650	52,420	48,970	58,400	55,570	55,340	48,300
	Total diversions	60,600	98,370	89,360	65,520	82,310	73,430	97,100	76,990	94,660	100,060	83,840
	Precipitation	19,850	33,960	18,540	24,290	24,220	31,050	26,390	25,500	32,950	30,420	26,720
	Total available supply	80,450	132,330	107,900	89,810	106,530	104,480	123,490	102,490	127,610	130,480	110,560
2B Beaver-Milford	Actual consumptive use	55,820	65,650	69,610	54,930	55,430	62,710	63,750	60,240	62,020	60,100	61,030
	Surface diversions	54,410	102,840	127,080	41,400	37,330	37,060	69,940	41,260	51,960	75,220	63,840
	Well diversions	45,200	44,400	42,560	44,600	50,850	45,060	46,870	45,790	48,940	39,710	45,400
	Total diversions	99,610	147,240	169,640	86,000	88,180	82,120	116,810	87,050	100,900	114,930	109,240
	Precipitation	10,890	31,050	18,210	13,220	17,910	24,560	22,260	21,760	20,680	24,730	20,530
	Total available supply	110,500	178,290	187,850	99,220	106,090	106,680	139,070	108,810	121,580	139,660	129,770
2B1 Cedar-Parowan	Actual consumptive use	29,330	37,960	37,470	25,500	27,040	35,310	35,910	38,990	35,250	42,560	34,530
	Surface diversions	21,120	52,970	83,930	15,950	18,850	21,720	52,450	25,340	38,470	72,080	40,290
	Well diversions	32,000	25,900	26,600	32,100	32,900	25,400	28,900	33,800	32,900	27,600	29,810
	Total diversions	53,120	78,870	110,530	48,050	51,750	47,120	81,350	59,140	71,370	99,680	70,100
	Precipitation	12,720	26,250	16,440	11,680	14,050	23,080	19,480	23,160	16,160	29,460	19,250
	Total available supply	65,840	105,120	126,970	59,730	65,800	70,200	100,830	82,300	87,530	129,140	89,350
2B2 Escalante Desert	Actual consumptive use	-	-	42,370	38,640	41,460	44,450	45,720	44,620	47,010	45,380	43,710[b]
	Surface diversions	-	-	11,220	6,750	5,660	5,220	9,460	5,150	4,570	8,320	7,040
	Well diversions	-	-	52,160	56,770	67,250	58,940	61,240	63,840	70,900	63,190	61,790
	Total diversions	-	-	63,380	63,520	72,910	64,160	70,700	68,990	75,470	71,510	68,830
	Precipitation	-	-	18,690	16,150	15,220	23,310	21,170	22,390	18,760	26,040	20,220
	Total available supply	-	-	82,100	79,710	88,130	87,470	91,870	91,380	94,230	97,550	89,050
Basin Total	Actual consumptive use	126,230[c]	156,280[c]	196,280	164,800	175,000	195,750	197,330	193,170	199,810	208,300	190,040[d]
	Surface diversions	101,390	216,890	271,150	82,490	91,500	85,010	179,980	90,340	134,090	200,340	146,710
	Well diversions	111,940	107,590	161,760	108,600	203,650	181,820	185,980	201,830	208,310	185,840	185,300
	Total diversions	213,330	324,480	432,910	263,090	295,150	266,830	365,960	292,170	342,400	386,180	332,010
	Precipitation	43,460	91,260	71,910	65,380	71,400	102,000	89,300	92,810	88,550	110,650	86,720
	Total available supply	256,790	415,740	504,820	328,470	366,550	368,830	455,260	384,980	430,950	496,830	418,730

[a] Summary from "Water Budget Analysis Supplement," Appendix II

[b] All average values for Escalante Desert subbasin are for the 1958-1965 period.

[c] Totals for 1956 and 1957 do not include Escalante Desert subbasin.

[d] Basin averages are sum of subbasin averages. Eight-year average for Escalante Desert subbasin was added with ten-year average of other subbasins.

Annual root-zone supplies were ranked and plotted to arrive at an expected root-zone supply (Table 4). Root-zone supply consists of well and surface diversions multiplied by an efficiency factor (Table 9) and precipitation, assumed to be 100 percent effective. This analysis assumes that irrigated acreages remain constant, but farmers generally vary irrigated acreages from year to year according to streamflow forecasts. For example, based on this assumption, water users in Kanosh can expect a root-zone supply of 6,900 acre-feet or more eight out of ten years, 9,400 acre-feet five out of ten years, and 11,800 acre-feet two out of ten years.

TABLE 4.--Frequency of annual root-zone water supply to irrigated crops Beaver River Basin, 1956-1965

Water budget area and subbasin		Percent chance of occurrence		
		20	50	80
		Acre-feet	Acre-feet	Acre-feet
2A-24	Fillmore	38,500	33,500	29,000
2A-25a	Meadow	11,200	10,400	9,800
2A-25b	Kanosh	11,800	9,400	6,900
2A Fillmore		61,500	53,300	45,700
2B-1	Beaver-Greenville	38,000	31,500	26,000
2B-2	Manderfield	3,330	2,670	2,150
2B-3,4,6	Minersville-Milford	36,500	32,000	28,000
2B Beaver-Milford		77,830	66,170	56,150
2B1-1c, 2,4	Cedar	26,000	21,000	17,400
2B1-1a, 3a	Summit	3,250	2,700	2,200
2B1-1b, 3b,3c	Parowan	18,600	16,000	13,400
2B1 Cedar-Parowan		47,850	39,700	33,000
2B2-1	Newcastle	8,700	7,700	6,800
2B2-2	Enterprise	7,350	6,900	6,500
2B2-3	Junction	34,000	31,000	28,000
2B2 Escalante Desert		50,050	45,600	41,300
Basin total		237,230	204,770	176,150

WETLANDS

Wetlands in the Pavant, Beaver, Parowan and Cedar areas are generally caused by artesian conditions, impermeable substrata and irrigation return flows. Wetlands were classified and mapped according to type of vegetation and depth to water table. Some low areas have nearly impermeable subsoils. Surface and seepage water is collected and held in these areas until it evaporates or is used by vegetation.

Wet areas, totaling 17,800 acres and covered by vegetation consisting mostly of greasewood, saltgrass, meadow grasses, and rabbitbrush, consumptively use 34,760 acre-feet annually (Table 5). About 4,100 acres of wetlands receive some irrigation. Consumptive use on all wetlands varies from one to five feet per year and averages about 1.95 feet.

TABLE 5.--Wetland areas and average annual consumptive use, Beaver River Basin, 1956-1965

Water budget area and subbasin		Depth to water table			Average consumptive use
		3-5 ft.	1-3 ft.	0-1 ft.	
		Acres	Acres	Acres	Acre-feet
2A-24	Fillmore	0	178	0	520
2A-25a	Meadow	176	546	34	1,690
2A-25b	Kanosh	0	196	0	470
2A Fillmore		176	920	34	2,680
2B-1	Beaver-Greenville	0	1,131	661	7,400
2B-2	Manderfield	55	108	0	420
2B-3,4,6	Minersville-Milford	0	2,045	0	3,430
2B Beaver-Milford		55	3,284	661	11,250
2B1-1c,2,4	Cedar	1,986	3,012	0	9,460
2B1-1a,3a	Summit	0	0	0	-
2B1-1b,3b, 3c	Parowan	3,348	2,179	45	8,980
2B1 Cedar-Parowan		5,334	5,191	45	18,440
2B2-1	Newcastle	847	71	0	1,020
2B2-2	Enterprise	156	0	0	160
2B2-3	Junction	1,014	8	0	1,210
2B2 Escalante Desert		2,017	79	0	2,390[a]
Basin total		7,582	9,474	740	34,760

[a]Average for 1958-1965.

DISTRIBUTION AND CONVEYANCE SYSTEMS

Information on management of existing irrigation company distribution and conveyance systems was obtained from interviews with local company officials, Soil Conservation Service files, and field inventories (Table 6). Canal lining expected to be installed by 1980 under going programs was estimated along with expected conveyance efficiencies and conditions (Table 7). Projections are based on the assumption that past trends will continue during the projected period. Data discussed here apply only to irrigation company canals and laterals and do not include on-farm ditches. Irrigation company distribution and conveyance systems vary throughout the Basin from good to poor. Basinwide, the condition is "poor". Projections show this condition will improve to "fair" by 1980 under going programs (Table 8).

There are approximately 50 irrigation companies serving about 63,700 acres (55 percent) of the irrigated land. These companies operate and maintain 420 miles of canals and laterals with individual capacities up to 100 cfs.

The overall Basin conveyance efficiency is 69 percent. At present (1965), about 97 miles (23 percent) of the company canals are lined and it is estimated that by 1980, an additional 88 miles (21 percent) will be lined under existing programs (Table 8).

Most irrigation companies are incorporated as nonprofit organizations and issue capital stock representing the owners right to water from the company system. Stockholders are assessed to cover the costs of administration, and for constructing, operating, and maintaining facilities.

Generally, a water master is assigned the responsibility of delivering water to the users according to their stock holdings. Water is delivered mainly on a rotation system, although some companies are able to deliver water on a demand or call basis. Engineering, legal, and other technical services are obtained as the need arises. In many instances, canals, laterals and other services are duplicated. Occasionally a water user will receive water from more than one canal for the same land.

Riparian vegetation grows on nearly all canal banks. Most canals have sections constructed in gravelly soils and seepage losses are high. Some canals traverse steep hillsides. Most irrigation companies divert water from streams but a few receive supplemental water from wells. Most large canals have grades of 1 to 5 feet per 1,000 feet, but some canals and laterals follow section lines and field boundaries where grades up to 15 feet per 1,000 feet are common. Floods, erosion, sediment deposition, burrowing animals and slides cause failures and high maintenance costs in many systems.

TABLE 6.--Irrigation company distribution and conveyance systems status, Beaver River Basin, 1965

Water budget area and subbasin		Area served	Canal length[a]	Conveyance efficiency	Canal lining			Canal condition[b]
					Open	Pipe	Total	
		Acres	Miles	Percent	Miles	Miles	Miles	
2A-24	Fillmore	9,000	51	65	6	0	6	Fair
2A-25a	Meadow	4,500	16	90	12	1	13	Good
2A-25b	Kanosh	5,300	24	66	9	0	9	Poor
2A Fillmore		18,800	91	69	27	1	28	Fair
2B-1	Beaver-Greenville	12,500	141	64	4	0	4	Poor
2B-2	Manderfield	1,500	7	65	3	0	3	Fair
2B-3, 4, 6	Minersville-Milford	6,000	29	73	6	0	6	Fair
2B-5	Cove Fort	400	8	66	0	0	0	Poor
2B Beaver-Milford		20,400	185	67	13	0	13	Poor
2B1-1c, 2, 4	Cedar	12,500	82	66	25	2	27	Poor
2B1-1a, 3a	Summit	1,000	4	74	2	0	2	Fair
2B1-1b, 3b	Parowan	5,200	31	65	4	9	13	Poor
2B1 Cedar-Parowan		18,700	117	66	31	11	42	Poor
2B2-1	Newcastle	3,300	11	80	3	2	5	Fair
2B2-2	Enterprise	2,500	16	70	8	1	9	Fair
2B2-3	Junction	0	0	0	0	0	0	--
2B2 Escalante Desert		5,800	27	76	11	3	14	Fair
Basin total		63,700	420	69	82	15	97	Poor

[a]Length includes sum of all company canals and laterals.

[b]Good - less than 3 percent loss per mile; fair - between 3 and 6 percent loss per mile; poor - greater than 6 percent loss per mile.

TABLE 7.--Projected irrigation company distribution and conveyance system improvements under going programs, Beaver River Basin, 1980

Water budget area and subbasin		Canal lining[a]			Condition[b]	Efficiency
		Open	Pipe	Total		
		Miles	Miles	Miles		Percent
2A-24	Fillmore	15	1	16	Fair	79
2A-25a	Meadow	0	0	0	Good	90
2A-25b	Kanosh	5	1	6	Poor	82
2A Fillmore		20	2	22	Fair	82
2B-1	Beaver-Greenville	14	4	18	Poor	71
2B-2	Manderfield	2	0	2	Fair	80
2B-3, 4, 6	Minersville-Milford	7	2	9	Good	82
2B-5	Cove Fort	0	0	0	Poor	66
2B Beaver-Milford		23	6	29	Fair	75
2B1-1c, 2, 4	Cedar	12	6	18	Fair	78
2B1-1a, 3a	Summit	2	0	2	Good	95
2B1-1b, 3b	Parowan	5	3	8	Poor	79
2B1 Cedar-Parowan		19	9	28	Fair	80
2B2-1	Newcastle	3	2	5	Good	92
2B2-2	Enterprise	4	0	4	Good	85
2B2-3	Junction	0	0	0	--	--
2B2 Escalante Desert		7	2	9	Good	89
Basin total		69	19	88	Fair	79

[a]Includes lining for irrigation companies or groups only, regardless of use.

[b]Condition based on following criteria: good - less than 3 percent loss per miles; fair - between 3 and 6 percent loss per mile; poor - greater than 6 percent loss per mile.

TABLE 8.--Existing and projected irrigation company canal lining, Beaver River Basin

Subbasin	Canal lining	
	Existing (1965)	Projected (1980)
	Percent	Percent
2A Fillmore	31	55
2B Beaver-Milford	7	23
2B1 Cedar-Parowan	36	60
2B2 Escalante Desert	52	85
Basin	23	44

IRRIGATION EFFICIENCIES

Over-all irrigation efficiencies are a product of on-farm and irrigation water distribution efficiencies. Separate efficiency values were used for each company, where available, and a weighted value determined for the area. Efficiencies were determined separately for the area served by wells and those served by surface systems. A weighted value was then obtained for each area (Table 9). Combined irrigation efficiency is 33 percent, ranging from 36 percent in the Escalante Desert to 28 percent in the Cedar Parowan subbasin. The Meadow Creek water budget area was most efficient at 41 percent and the Beaver-Greenville and Parowan water budget areas least efficient at 26 percent.

The on-farm efficiency was highest (50 percent) in the Minersville-Milford water budget area, and lowest (37 percent) in the Parowan water budget area. Water conveyance efficiency was highest in the Meadow area (90 percent) and lowest in the Beaver-Greenville area (65 percent).

Irrigation efficiencies vary considerably between water budget areas and irrigation companies; however, the variation between subbasins is slight. The conveyance efficiencies vary from 70 percent to 83 percent and on-farm efficiencies vary from 40 to 46 percent between subbasins.

Generally, the highest over-all efficiencies are obtained in areas served by wells. This results from: (1) high cost of water, which discourages waste or excessive pumping; (2) flatter land which affords better irrigation control; (3) less conveyance loss; and (4) pumping limitations imposed by state regulations.

Expected irrigation efficiencies by 1980 are shown in Table 10. Projections are based on continuation of past trends and opportunities. Increased efficiencies are based on improved on-farm land treatment measures, and more canal lining, and other structural measures.

TABLE 9.--Irrigation efficiency, Beaver River Basin, 1965

Water budget area and subbasin		Conveyance			On-farm			Over-all total		
		Wells	Surface	Weighted total	Wells	Surface	Weighted total	Wells	Surface	Weighted total
		Percent								
2A-24	Fillmore	78	65	72	46	46	46	36	30	33
2A-25a	Meadow	90	90	90	46	46	46	41	41	41
2A-25b	Kanosh	90	66	80	46	46	46	41	30	37
2A Fillmore		83	69	77	46	46	46	38	32	35
2B-1	Beaver-Greenville	75	64	65	40	40	40	30	25	26
2B-2	Manderfield	80	65	70	40	40	40	32	26	28
2B-3, 4, 6	Minersville-Milford	75	73	74	50	50	50	38	36	37
2B-5	Cove Fort	--	66	--	--	30	--	--	20	--
2B Beaver-Milford		75	67	70	49	43	45	37	29	32
2B1-1c, 2, 4	Cedar	76	66	70	46	38	42	35	25	29
2B1-1a, 3a	Summit	75	74	74	48	34	38	36	25	28
2B1-1b, 3b, 3c	Parowan	75	65	69	45	31	37	34	20	26
2B1 Cedar-Parowan		75	66	70	47	35	40	35	23	28
2B2-1	Newcastle	80	80	80	40	40	40	32	32	32
2B2-2	Enterprise	80	70	77	40	40	40	32	28	31
2B2-3	Junction	85	--	85	45	--	45	38	--	38
2B2 Escalante Desert		84	76	83	44	40	44	37	30	36
Total Basin		80	69	74	46	40	44	37	28	33

TABLE 10.--Projected irrigation efficiency with continuation of going program, Beaver River Basin, 1980

Water budget area and subbasin		Conveyance			On-farm			Over-all total		
		Wells	Surface	Weighted total	Wells	Surface	Weighted total	Wells	Surface	Weighted total
		Percent								
2A-24	Fillmore	85	79	83	54	54	54	46	42	45
2A-25a	Meadow	93	90	92	54	54	54	50	49	50
2A-25b	Kanosh	93	82	89	54	54	54	50	44	48
2A	Fillmore	89	82	86	54	54	54	48	44	46
2B-1	Beaver-Greenville	83	71	72	52	52	52	43	37	37
2B-2	Manderfield	86	80	83	52	52	52	45	42	43
2B-3, 4, 6	Minersville-Milford	87	82	85	62	62	62	54	51	53
2B-5	Cove Fort									
2B	Beaver-Milford	87	75	80	61	55	57	53	41	46
2B1-1c, 2, 4	Cedar	85	78	81	55	47	50	47	37	41
2B1-1a, 3a	Summit	94	95	95	57	43	47	54	41	45
2B1-1b, 3b, 3c	Parowan	85	79	82	54	40	46	46	32	38
2B1	Cedar-Parowan	86	80	83	55	44	48	47	35	40
2B2-1	Newcastle	92	92	92	50	50	50	46	46	46
2B2-2	Enterprise	90	85	89	50	50	50	45	43	45
2B2-3	Junction	89	--	89	55	--	55	49	--	49
2B2	Escalante Desert	89	89	89	54	50	54	48	45	48
Total Basin		87	79	84	56	51	54	49	40	45

RESERVOIRS AND LAKES

Existing reservoir and lake storage facilities are used mainly for irrigation water. Storage is also provided for flood control, sediment, power, recreation, fish and wildlife, municipal and industrial water supplies, and stockwater.

Two subbasins have limited storage capacities. Storage capacity of about 750 acre-feet in the Sevier Lake subbasin is used almost entirely for stockwater. Storage capacity of about 180 acre-feet in the Fillmore subbasin is used mainly for sediment storage.

The Beaver-Milford subbasin has about 30,000 acre-feet of available irrigation storage which is more than the balance of the Basin combined. About 23,000 acre-feet of irrigation storage is provided in Minersville Reservoir. Approximately 900 acre-feet of sediment and flood control storage capacity has been recently developed through construction of the Minersville PL 566 Watershed Project.

Storage facilities are limited in the Cedar-Parowan subbasin to about 4,900 acre-feet. Approximately 240 acre-feet of sediment and flood storage are provided in the Green's Lake PL 566 Watershed Project debris basins completed in 1959. The Escalante Desert subbasin has about 15,000 acre-feet of irrigation storage and smaller amounts of storage for stockwater.

Existing reservoirs and lakes are listed in Table 11 and located on the map following page 20. Information listed includes location, capacity, surface area, drainage area, and primary purpose. This information was obtained from various sources including U.S. Geological Survey Water Supply Paper 920, Conservation Needs Inventory, Utah State Engineer's Biennial Reports, and Soil Conservation Service files.

TABLE 11.--Reservoirs and lakes, Beaver River Basin, 1965

Name[a]	Stream	Location T	R	S	Capacity	Surface area	Drainage area	Purpose[b]	Remarks	Source of information[c]
					Ac. ft.	Acres	Sq. mi.			
Sevier Lake Watershed (2-1)										
2-1A Dutchman	Wah Wah Wash	26S	14W	22					f	
2-1B Lake View	Pine Creek	24S	12W	26	527	[d](32)		St		CNI
2-1C Lawson Cove	Lawson Cove	24S	14W	27					f	
2-1D Lone Ridge	Unnamed Wash	18S	12W	26					f	
2-1E New House	Wah Wah Wash	26S	14W	26					f	
2-1F Sevier Lake	Sevier River	22S	12W						Dry Lake	SCS
2-1G Wah Wah	Wah Wah Springs	27S	14W	4	220	63		St		SCS
2-1H Unnamed	Soap Wash	18S	11W	14					f	
2-1I Unnamed	Unknown	21S	13W	23					f	
2-1J Unnamed		21S	13W	14					f	
Chalk Creek Watershed (2A-24)										
2A-24A Chalk Creek, D.B.	Chalk Creek	21S	4W	28	46[g]	6	60.8	S	Filled with debris	SCS
Corn Creek Watershed (2A-25)										
2A-25A Corn Fan	Corn Creek	23S	5W	27	20	5	94.0	I		CNI
2A-25B Dog Valley	Dog Valley Creek	24S	6W	34	2			St	Not in use	
2A-25C Dry Creek, Debris Basin	Dry Creek	23S	5W	1			6.6	S, FC		
2A-25D Meadow Creek, D.B.	Meadow Creek	22S	5W	13	100	(10)	14.0	S, FC		SCS
2A-25E West Meadow		22S	5W	17					f	
Beaver Watershed (2B-1)										
2B-1A Anderson Meadow	South Fork of Beaver River	30S	5W	16	232	15	12.0	F		USGS
2B-1B Birch Lake	Birch Creek	29S	6W	36					f	SCS
2B-1C Blue Lake	South Fork of Beaver River	28S	5W	4	370	20	2+	I		USGS
2B-1D Puffer Lake	Lake stream	29S	5W	1	897	75	2.5	F, P		USGS
2B-1E Hi-Low	South Fork of Beaver River	29S	6W	25	9	(2)		I		USGS
2B-1F Labaron Reservoir	East Fork of Beaver River	30S	5W	3	257	22	0.9	F	Aka[e] Blaney	USGS
2B-1G Little Reservoir	South Fork of Beaver River	29S	6W	25	21	7		F		CNI
2B-1H Lower Kent's Lake	South Fork of Beaver River	29S	5W	21	180	15	2.0		Not in use - breached	USGS
2B-1I Merchants Valley	Beaver River	29S	5W	17	40	(10)		P	Diversion dam	SCS
2B-1J Middle Kent's Lake	South Fork of Beaver River	30S	5W	6	600	40	2.0	I		USGS
2B-1K Mud Lake	West Fork, Merchant Creek, Beaver River	28S	5W	15	(3)	(1)		St	Small closed basin	SCS
2B-1L Otter Lake	Lake stream, Beaver River	29S	5W	1,12	80	12		F	Private ownership - three small lakes	USGS
2B-1N Three Creeks	Three Creeks, Beaver River	29S	5W	9	2,230	60	17.3	I, P, FC		USGS
2B-1O Tipperary	North Creek	29S	8W	26	125	30	3+	I		USGS
2B-1P Twin Lakes	Merchant Creek	28S	5W	26	35	12			Not in use	
2B-1Q Upper Kent's Lake	South Fork of Beaver River	30S	5W	5	150	30	2.0	I		CNI
2B-1R Unnamed	South Creek	29S	7W	32					f	
Wildcat Creek Watershed (2B-2)										
2B-2A Beaver Arid Farm	Indian Creek	28S	7W	32	73	17		I		SCS
2B-2B Beaver Dam #1	Indian Creek	27S	6W	36	320	25	12.0	I	Aka Manderfield	USGS
2B-2C Beaver Dam #2	Indian Creek	27S	6W	25	110	9	2.0	I	Aka Indian Creek	USGS
2B-2D Gillies	Wildcat Creek	27S	7W	33	10	(2)		I	Equalizing Reservoir	USGS
2B-2E Stewart	Spring Cherry Creek	29S	9W	12	5	(1)		I	Equalizing Reservoir	USGS
Minersville Watershed (2B-3)										
2B-3A Burnt Spot Pond		31S	10W	22				St	f	
2B-3B Chalk Hollow Pond		31S	8W	7				St	f	
2B-3C Hot Springs Canyon Pond		31S	11W	19				St	f	
2B-3D Monument Knolls	Unnamed	31S	11W	6				St	f	
2B-3E Mound Pond	Ditch	30S	11W	24				St	f	
2B-3F Penny Hollow Pond		31S	10W	14						
2B-3G Minersville	Beaver River	30S	9W	11	23,260	1,177	510.0	I, FC	Aka Rocky Ford Dam	USGS
2B-3H Sand Pond	Ditch	30S	11W	24					f	
2B-3J Big John	Misc. small wash	30S	10W	13	612	34	18.0	FC	PL-566	SCS
2B-3K Red Hills	Big Wash	30S	10W	24	316	41	5.2	FC	PL-566	SCS
Milford Watershed (2B-4)										
2B-4A The Big Wash	The Big Wash	28S	12W	4				St	f	
2B-4B West Point	Big Wash	27S	11W	33	325		63	FC		CE

TABLE 11.--Continued

Name[a]	Stream	Location T	R	S	Capacity	Surface area	Drainage area	Purpose[b]	Remarks	Source of information[c]
					Ac. ft.	Acres	Sq. mi.			
Cove Creek Watershed (2B-5)										
2B-5A Cove Fort	Cove Creek	25S	7W	24				St	Very small	USGS
Black Rock Watershed (2B-6)										
2B-6A C. W. Hudgson		26S	8W	33				St	f	
2B-6B Danish	Cove Creek	25S	8W	24				St	f	
2B-6C Unnamed		24S	10W	22				St	f	
2B-6D Unnamed		24S	9W	35				St	f	
Jacobs Well Watershed (2B-7)										
2B-7A Black Point		23S	7W	8				St	f	
2B-7B Clear Spot		22S	8W	35				St	f	
2B-7C Hole in the Rock		22S	7W	29				St	f	
Coal Creek Watershed (2B1-1)										
2B1-1A Brafitt Creek	Brafitt Creek	35S	10W	10,11					f	
2B1-1B Fiddlers D. B.	Fiddlers Canyon	35S	11W	26,35	15	3	12.6	FC, S		SCS
2B1-1C Hendrickson Lake	Parowan Creek	35S	8W	31				F	Small natural lake	SCS
2B1-1D Maple Springs	Center Creek	34S	9W	34				S	Very small	USGS
2B1-1E Yankee Meadows	Bowery Creek	35S	8W	20	835	60	7.0	FP, I		CNI
Green's Lake Watershed (2B1-2)										
2B1-2A Debris Basin #1	Near Cedar City	36S	11W	23	3	1	0.02	FC, S	PL-566 small watershed	SCS
2B1-2B Debris Basin #2	Near Cedar City	36S	11W	23	22	2	0.65	FC, S	PL-566 small watershed	SCS
2B1-2C Debris Basin #3	Green's Lake Creek	36S	11W	23	46	4	1.3	FC, S	PL-566 small watershed	SCS
2B1-2E Retarding Dam #4	Green's Lake Creek	36S	11W	36	35	3	0.79	FC, S	PL-566 small watershed	SCS
2B1-2F Retarding Dam #5	Green's Lake Creek	36S	11W	21	120	9	2.36	FC, S	PL-566 small watershed	SCS
Red Creek Watershed (2B1-3)										
2B1-3A Coop Valley Sinks	Hoosier Creek	34S	8W	25	2,394	150		I	Inactive-dam destroyed	CNI
2B1-3B Hoosier Lake	Hoosier Creek	34S	8W	35				I	f	SCS
2B1-3C Little Salt Lake	Parowan, Red, Summit, etc.	33S	9W	29		2,440			Intermittent	SCS
2B1-3D Red Creek	Red Creek	34S	7W	7	1,443	50		I, FC		CNI
Quichapa Watershed (2B1-4)										
2B1-4A Quichapa Lake	Coal Creek	36S	12W	28		900			Intermittent	SCS
Pinto Creek Watershed (2B2-1)										
2B2-1A Harrison	Spring Creek	38S	15W	8					f	
2B2-1B Holtville	Meadow Creek	37S	16W	10				I		
2B2-1C Newcastle	Pinto Creek	36S	15W	22	3,840	100	133.0	I, FC		CNI
2B2-1D Unnamed	Pinto Creek	38S	15W	2					f	
Shoal Creek Watershed (2B2-2)										
2B2-2A Enterprise Lower #1	Little Pine Creek	37S	18W	34	2,400	75		I, F, FC		USGS
2B2-2B Enterprise Upper #2	Little Pine Creek	37S	18W	34	8,500	335	27.0	I, F, M, FC		USGS
2B2-2C Holt Farm	Meadow Valley	36S	16W	28				I	Very small	USGS
Beryl Watershed (2B2-3)										
2B2-3A Modena City	Unnamed Canyon	34S	19W	11					Full of silt	
2B2-3B Modena	Modena Wash	35S	18W	6	250	61.3	80.0	St		CNI
Big Hollow Watershed (2B2-4)										
2B2-4A Big Hollow	Big Hollow Wash	35S	13W	14		50		St		
2B2-4B Iron Springs	Iron Springs Creek	35S	12W	18				St	Very small	USGS

[a]Number is for map location and identification only.

[b]Purpose: F - Fishing; FC - Flood Control; I - Irrigation; MI - Municipal and Industrial; P - Power; R - Recreation; S - Sediment; St - Stockwatering.

[c]Source of Information: CNI - Conservation Needs Inventory (unpublished report); SCS - Soil Conservation Service Work Unit or River Basin Staff; U - Utah State Engineer Biennial Reports; USGS - United States Geological Survey Water Supply Paper 920; CE - Corp of Engineers.

[d]Values in parentheses ( ) are estimated.

[e]Aka - Also known as.

[f]Additional data not available.

[g]Original capacity.

WELLS

Irrigation wells provided more than 50 percent of the irrigation water diverted during the 1956-1965 base period (Table 3). This supply varied from approximately 90 percent in the Escalante Desert subbasin to about 40 percent in the Beaver-Milford subbasin.

Basic data reports prepared by the U.S. Geological Survey (1963) give data for selected wells in the Basin including location, owner, year drilled, depth, size, method of lift, type of power, horsepower and yield (Table 12). The location of irrigation wells is shown on the map following page 20.

Most wells are used for irrigation, but some are used for domestic and stock water. Wells used for stock water and domestic purposes are generally four to six inches in diameter and supply less than 50 gallons per minute (gpm). Irrigation wells are commonly 14 to 16 inches in diameter and yield 500-600 gpm.

Some irrigation wells were in use as early as 1915 and more than half of the wells were installed before 1950. Some irrigation wells are more than 900 feet in depth, but most are 100 to 300 feet. Most of the old, small, and shallow wells are in the Fillmore subbasin.

Almost half of the irrigation wells in the Fillmore subbasin were allowed to flow during the early part of the irrigation season during 1956-1965. A few flowing wells for domestic and stock watering use still exist in all except the Escalante Desert subbasin. In recent years, yields from flowing wells have decreased as the number of pumped wells and pumping rate has increased.

Many small regulating reservoirs are used in conjunction with irrigation wells to store small flows overnight or for one or two days. Water is then released from the reservoirs in larger streams for better management.

Ground-water levels fluctuate seasonally and from year to year. Generally, water levels are declining, indicating that the ground-water supply is being depleted. Consequently, in recent years, the Utah State Engineer has rejected new applications to appropriate water for irrigation in the Beaver River Basin.

TABLE 12.--Selected irrigation well data, Beaver River Basin, 1963

Item	Subbasin: Fillmore	Beaver-Milford	Cedar-Parowan	Escalante Desert	Basin total
Number of wells	174[b]	176[c]	152	202	704
Earliest year drilled	1915	1918[a]	1922	1926	1915[a]
Depth (feet)					
Maximum	900	949	665	483	949
Minimum	90	51	70	75	51
Most common	200-300	100-200	200-300	100-200	200-300
Diameter (inches)					
Maximum	20	18	24	20	24
Minimum	4	7[a]	6	10	6[a]
Most common	16	14	14	16	14
Yield (gpm)					
Maximum	3,500	1,850	1,200	1,960	3,500
Minimum	6	157	125	140	6
Most common	1500-2000	300-200	600-700	800-900	500-600

[a]Exception - one 2" diameter well drilled in 1905.

[b]Approximately 110 irrigation wells were used during 1963.

[c]Approximately 158 irrigation wells were used during 1963.

Source: U. S. Geological Survey Basic Data Reports (1963)

RESERVOIRS AND IRRIGATION WELLS

NORTH PORTION

BEAVER RIVER BASIN

UTAH- NEVADA

June 1971

SCALE IN MILES 5 0 5 10

SOURCES: Wells-USGS Basic Data Reports 1963
Reservoirs-USGS Water Supply Paper 920
Conservation Needs Inventory
Utah State Engineer's Biennal Report
Soil Conservation Service

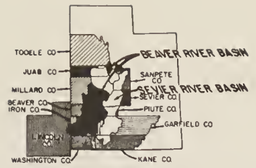
LEGEND

Capacity (Ac.-Ft.)

Reservoirs-
- ○ <100
- ◎ 100-1,000
- ◎ 1,000-10,000
- ◎ >10,000

Wells-
- 28-18 Identification Number

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE



LOCATION MAP

LOCATION MAP OF SUB-BASINS

LEGEND

LEGEND

Reservoirs – Capacity (Ac.-Ft.)
- < 100
- 100–1,000
- 1,000–10,000
- > 10,000

282-1B Identification Number

Wells –

RESERVOIRS AND IRRIGATION WELLS
SOUTH PORTION
BEAVER RIVER BASIN
UTAH - NEVADA

June 1971

5 0 5 10
SCALE IN MILES

SOURCES: Wells–USGS Basic Data Reports 1963
Reservoirs–USGS Water Supply Paper 920
Conservation Needs Inventory
Utah State Engineer's Biennal Report
Soil Conservation Service

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

DOMESTIC AND INDUSTRIAL WATER USE

Domestic and industrial water diversions of 15,360 acre-feet for 1960 were tabulated by Harline.[1] The domestic supply totaled 5,620 acre-feet and industrial diversions 9,740 acre-feet. Domestic water supplied a Basin population of 19,280 including a rural population of 2,350 and a municipal population of 16,930.

RURAL DOMESTIC WATER USE

Rural domestic water diversions were 690 acre-feet in 1960. Domestic use of diverted supply was estimated at 420 acre-feet (60 percent of that diverted, Table 13). Most of the rural families use individual pumped wells for their supply, although some rely on flowing wells.

TABLE 13.--Estimated rural population and domestic water use, Beaver River Basin, 1960

Subbasin	Rural population	Water diverted		Water used[a]	
		Annual total	Per capita	Annual total	Per capita
		Acre-feet	Gallons	Acre-feet	Gallons
Fillmore	360	120	300	70	180
Beaver-Milford	730	280	340	170	200
Cedar-Parowan	680	160	200	100	120
Escalante Desert	580	130	210	80	130
Basin	2,350	690	280[b]	420	160[b]

[a]Based on consumptive use of 60 percent diverted supply.
[b]Weighted value.

If current trends continue, rural population will decrease in the future as large farms replace smaller units and farm operations become more automated. For example, the population in the unincorporated areas of Millard County has decreased from 3,174 in 1940 to 2,185 in 1960, or 31 percent. This magnitude of change may not continue, but the trend is apparent. Future rural domestic diversions will decrease, but the rate of decrease will be less than the population decline.

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[1]Harline, Dr. Osmond, "Use of Water for Municipal and Industrial Purposes-Utah Counties," 1960-1961.

Future rural domestic use was estimated for the 1980, 2000 and 2020 period (Table 14).

TABLE 14.--Projected annual rural domestic water use, Beaver River Basin, 1980, 2000, and 2020

Subbasin	1980	2000	2020
	Acre-feet	Acre-feet	Acre-feet
Fillmore	70	60	50
Beaver-Milford	150	130	120
Cedar-Parowan	80	80	70
Escalante Desert	70	60	60
Basin total	370	330	300

MUNICIPAL AND INDUSTRIAL USE

Municipal and industrial diversions totaled 14,670 acre-feet for 1960 or 773 gallons per day per capita. Municipal diversions accounted for 4,920 acre-feet with 9,740 acre-feet being diverted for industrial use (Table 15). Cedar-Parowan industrial diversions accounted for 9,040 acre-feet.

Municipal and industrial water supplies came mainly from wells and springs (Table 16). If springs of good quality are available, they are generally used. Wells are used to supplement springs or for the entire supply where springs are not available. Most municipal water supplies are provided from community-owned systems; however, Cedar City had a total of 170 private wells in operation during 1960. Some communities do not have a central water system and rely mainly on private wells. Seven percent of the industrial supply came from municipal systems while the remainder came from private sources.

Municipal diversions and population are expected to increase 35 percent by 2020. Per capita water use is expected to increase in future years. Industrial diversions are expected to more than double by 2020. Cedar-Parowan will account for the majority of this increase.

TABLE 15.--Present and projected annual water diversions for municipal and industrial use, Beaver River Basin, 1960, 1980, 2000, and 2020

Subbasin	Municipal		Industrial	Total
	Acre-feet	Gal/day/capita	Acre-feet	Acre-feet
1960				
Fillmore	740	210	170	910
Beaver-Milford	1,460	360	470	1,940
Cedar-Parowan	1,850	180	9,040	10,890
Escalante Desert	870	900	60	930
Basin total	4,920	260 [a]	9,740	14,670
1980				
Fillmore	650	240	190	840
Beaver-Milford	1,180	380	460	1,640
Cedar-Parowan	2,380	190	15,920	18,300
Escalante Desert	800	870 [a]	110	920
Basin total	5,010	260	16,680	21,700
2000				
Fillmore	690	250	240	930
Beaver-Milford	1,210	410	420	1,630
Cedar-Parowan	3,020	190	18,570	21,590
Escalante Desert	700	830 [a]	70	770
Basin total	5,620	250	19,300	24,920
2020				
Fillmore	760	260	200	970
Beaver-Milford	1,220	440	630	1,850
Cedar-Parowan	4,180	220	21,940	26,110
Escalante Desert	540	800 [a]	130	670
Basin total	6,700	260	22,900	29,600

[a] Weighted values.

TABLE 16.--Status of public water systems by selected communities, Beaver River Basin, 1968

Community	Water sources	Individuals served	Classification[a]			
			Approved	Provincial approval	Pending	Not approved
Beaver City	Baker Canyon Springs and two wells	1,800	X			
Cedar City	Eleven springs and five wells	9,500	X			
Enoch	Wells	50	X			
Enterprise	Pendleton Range Spring, Calf Spring & one well					
Eureka	Four wells					
Fillmore	Springs in Chalk Creek and two wells	1,450		X		
Kanosh	Springs	350			X	
Lund	Well	50	X			
Meadow	Springs	250				X
Milford	Wells	1,350		X		
Minersville	Three springs and one well	500	X			
Modena	Well	100				X
Newcastle	Springs	100				X
Paragonah	Springs & one well	300				X
Parowan	Springs & one well	1,500		X		
Summit	Kimpie Spring & others	140				X

Source: Utah State Department of Health

[a]Classification on following page.

The four classifications for public water systems used by the Utah State Department of Health are:

"Approved": (1) The system has no defects which might result in water contamination, (2) the required number of samples has been submitted for bacteriologic analysis, (3) bacteriologic quality of the water has met the requirements, and (4) operation reports (where required) have been submitted regularly.

"Provisionally Approved": (1) The supply has met all of the requirements for an "Approved" rating, except for minor defects in the process of being corrected.

"Not Approved": (1) Bacteriological quality of the water has not met the requirements, or (2) the required number of water samples has not been submitted regularly for bacteriologic analysis, and (3) the system has defects not in the process of being corrected, and (4) operation reports (where required) have not been submitted regularly.

"Classification Pending": Related to "Not Approved" supplies for which acceptable plans and timetable for improvements have been submitted and accepted. The plans must insure correction of system deficiencies. The rating is continued, so long as the planning improvements are completed on an agreed-to schedule and until a suitable surveillance program is conducted. Following the conclusion of the surveillance program, the system is re-rated.

LIVESTOCK, FISH AND WILDLIFE USE OF WATER

Water is essential to sustain domestic and wild animal life and plays a major role in the distribution, life cycles and environment of all species. Water management can enhance habitat aspects through new development where resources are now lacking. On the other hand, animals may be denied access to water when it is confined in pipelines, reservoirs, or other structures. Changes in environment caused by manipulation of water supplies can drastically affect wildlife habitat.

LIVESTOCK

Livestock water developments vary, and include windmills, spring developments, and small reservoirs to trap surface runoff. Pipelines deliver spring water from higher elevations to valley areas for livestock use. Hauling water by truck provides water where other supplies are not available. Hauling is presently used to supply water for sheep, but high cost limits this method for range cattle. A report, "Hydrology of Stock Water Development on the Public Domain of Western Utah", Water Supply Paper 1475-N, 1963, U. S. Geological Survey, locates existing and potential sources of water in the desert part of the Basin.

Average daily consumption of water by range cattle varies from 2.6 gallons per day during the winter to 6.3 gallons during the hottest summer months. Sheep require about 1.5 to 3.0 gallons of water per day. Water requirements vary with the succulence of forage, dew on the vegetation, humidity, temperature and other factors. With evaporation and wastage, about 15 gallons per head, per day, should be available for cattle use. On this basis, range livestock requirements are 177 million gallons or about 6,629 acre-feet annually.

Some under-ground water in closed desert basins is unpalatable to livestock. Management should be directed towards maintaining quality as well as developing new supplies.

FISH

Fish habitat is effected by variations in water supply, temperature, and quality. Requirements for trout include clear, clean water, adequate flow, and suitable water temperature. Optimum water temperature for most trout species is about 58°F., but trout may survive in water temperatures up to 70°F., or more, if other conditions are right. Minimum flows should be at least 3.0 cfs with adequate depth. Appendix I, Beaver River Basin, contains an inventory of Basin streams and their characteristics for fish habitat. These characteristics should be considered in making water management decisions.

WILDLIFE

Distribution of many wildlife species in the desert area is limited by inadequate water. Antelope are especially affected, as are chukars and mourning doves. One water development has been established for big game and other opportunities have been inventoried by the Bureau of Land Management for 83 additional big game water developments and 200 developments for upland game birds.

HYDROELECTRIC POWER

Six hydroelectric plants were operational in 1965. Two of the plants are owned and operated by Parowan City Corporation, two by Beaver City Corporation and the remaining two by Utah Power and Light Company. Beaver City Corporation power plants are interconnected with Utah Power and Light system. Parowan City Corporation is interconnected with California Pacific Utilities Company and also purchases power from the Colorado River Storage Project.

The two plants of Parowan City Corporation are situated at Parowan and Paragonah. The plant at Paragonah is approximately one mile east of town and utilizes water from Red Creek to generate power. Seasonal releases from Red Creek Reservoir are supplemented by flows from springs. The plant at Parowan diverts water from Center Creek immediately below the confluence of Bowery and Parowan Creeks. The four remaining hydroelectric plants are all on the Upper Beaver River system.

Table 17 shows the year of installation, installed capacity and 1965 power generations for each of the six plants. Some smaller hydroelectric plants were built during the early 1900's, but were later abandoned primarily because of inadequate water supply and high operating costs.

Future growth will put increased demands on the available electric power supply. Limited streamflows reduce the possibility of new hydroelectric power plants or increased peaking capacity at existing plants.

TABLE 17.--Date of initial operation, installed capacity and 1965 power generation for hydroelectric plants, Beaver River Basin[a]

Plant	Year of initial operation	Installed capacity	1965 power generation
		Kilowatts	Million kilowatt-hours
Utah Power & Light Company			
Upper Beaver	1907	2,400	10.7
Lower Beaver	1919	600	3.5
Beaver City Corporation			
Beaver No. 1	1942	625	3.5
Beaver No. 2	1904	275	0.4
Parowan City Corporation			
Parowan	1907	600	3.5
Paragonah	1955	500	2.0

[a]Appendix XIV, Electric Power; Great Basin Region Comprehensive Framework Study (1971).

Chapter II

L A N D U S E A N D M A N A G E M E N T

The Beaver River Basin encompasses 8,191 square miles and includes a wide variety of land uses. This chapter discusses watershed, cropland, grazing land, forest products, fire, insect and disease protection, mining, and miscellaneous land use and management.

Private lands were classified by areas of dominant use. Private lands make up about 20 percent of the Basin area. About 79 percent of the private land is rangeland and 21 percent is cropland, urban, or miscellaneous land (Table 18 and Figure 1). More detailed information is available in the "Water Related Land Use Inventory" supplement to this appendix. This supplement includes delineations of cropland, pasture land, rangeland adjacent to or intermixed with cropland, and miscellaneous land such as cities, towns, airports, roads, railroads, farmsteads, and water surfaces.

Figure 1: Land use on private lands, Beaver River Basin, 1965

TABLE 18.--Land use, private lands, Beaver River Basin, 1965

Watershed and subbasin		Cropland[a]			Rangeland			Miscellaneous				
		Irrigated	Non-irrigated	Subtotal	Range[b]	Forest[c]	Subtotal	Water[d]	Urban[e]	Other[f]	Subtotal	Total
		Acres										
2-1	Sevier Lake	110	0	110	13,880	0	13,880	20	0	50	70	14,060
2	Sevier Lake	110	0	110	13,880	0	13,880	20	0	50	70	14,060
2A-19	Tintic	0	4,360	4,360	37,030	0	37,030	10	810	1,070	1,890	43,280
2A-24	Chalk Creek	16,630	18,740	35,370	25,910	710	26,620	60	1,170	2,260	3,490	65,480
2A-25	Corn Creek	12,570	18,830	31,400	37,850	1,390	39,240	80	610	1,890	2,580	73,220
2A	Fillmore	29,200	41,930	71,130	100,790	2,100	102,890	150	2,590	5,220	7,960	181,980
2B-1	Beaver	10,980	2,470	13,450	18,780	240	19,020	1,050	740	720	2,510	34,980
2B-2	Wildcat Creek	1,650	1,160	2,810	13,080	250	13,330	20	0	130	150	16,290
2B-3	Minersville	18,860	1,090	19,950	21,250	0	21,250	260	360	1,620	2,240	43,440
2B-4	Milford	590	150	740	15,170	0	15,170	20	430	180	630	16,540
2B-5	Cove Creek	300	1,610	1,910	4,700	580	5,280	0	0	160	160	7,350
2B-6	Black Rock	170	0	170	75,570	0	75,570	30	0	500	530	76,270
2B-7	Jacobs Well	0	0	0	13,820	0	13,820	0	0	320	320	14,140
2B	Beaver-Milford	32,550	6,480	39,030	162,370	1,070	163,440	1,380	1,530	3,630	6,540	209,010
2B1-1	Coal Creek	13,210	6,920	20,130	58,800	23,400	82,200	70	2,540	2,110	4,720	107,050
2B1-2	Green's Lake	340	290	630	2,730	530	3,260	0	500	170	670	4,560
2B1-3	Red Creek	8,030	9,860	17,890	44,530	6,100	50,630	230	210	3,830	4,270	72,790
2B1-4	Quichapa Creek	2,970	5,210	8,180	47,160	0	47,160	130	0	1,150	1,280	56,620
2B1-5	Rush Lake	260	40	300	9,670	0	9,670	10	0	60	70	10,040
2B1-6	Other	0	0	0	0	0	0	0	0	0	0	0
2B1	Cedar-Parowan	24,810	22,320	47,130	162,890	30,030	192,920	440	3,250	7,320	11,010	251,060
2B2-1	Pinto Creek	5,780	1,900	7,680	33,520	0	33,520	130	130	1,320	1,580	42,780
2B2-2	Shoal Creek	5,120	1,740	6,860	11,720	540	12,260	40	260	500	800	19,920
2B2-3	Beryl	17,650	6,020	23,670	167,320	0	167,320	150	0	1,720	1,870	192,860
2B2-4	Big Hollow	0	0	0	152,660	0	152,660	0	0	2,300	2,300	154,960
2B2-5	Other	0	0	0	150	0	150	0	0	0	0	150
2B2	Escalante Desert	28,550	9,660	38,210	365,370	540	365,910	320	390	5,840	6,550	410,670
Totals		115,220	80,390	195,610	805,300	33,740	839,040	2,310	7,760	22,060	32,130	1,066,780

[a]Includes irrigated and nonirrigated pasture.

[b]All of this land may presently not be grazed.

[c]Includes land on which forest products could be harvested (forested lands) but which may also be used for grazing.

[d]Includes ponds, lakes and reservoirs of more than one acre and all major reservoirs on private land.

[e]Includes cities, towns, cemeteries, airports, golf courses and railroad yards.

[f]Includes farmsteads, roads, railroads, lava beds, dry lakes and mining areas.

The Bureau of Land Management administers 61 percent of the land within the Basin. These lands are managed, developed, and protected for domestic livestock grazing, fish and wildlife development and utilization, industrial development, mineral production, occupancy, outdoor recreation, timber production, watershed protection, wilderness preservation, and preservation of public values, including environmental values. The lands, resources, environment, and public values therein are protected from avoidable destruction, abuse, and deterioration.

Public domain lands and resources are managed, developed, and disposed of to maintain a quality environment, to help meet the people's need for the lands and their resources, and to contribute to the stability and orderly growth of dependent users, industries, communities, and regions.

The Bureau of Land Management, in deciding among alternative uses of available resources, utilizes both physical and social data in evaluating the immediate and long-range impact of proposed actions on environmental quality and ecological balance.

Most of Cedar Breaks National Monument is within the Coal Creek Watershed and is administered by the National Park Service. Public services are provided. The management objective is to protect the plants, animals and unique geological formations, which are the prime scenic attraction.

The third major segment of public land includes portions of the Fishlake and Dixie National Forests comprising 11 percent of the total area. These areas are managed to achieve a pattern of multiple resource use that will best meet present and future needs. Protection and management involving quality of air, water, soil and natural beauty are coordinated with land uses related to recreation, water supply, forage, fish and wildlife, and forest products.

Lands owned by the State of Utah occupy eight percent of the area. These lands are mostly in scattered school sections, and are used mainly as rangelands, which are leased to individuals. The Utah Division of Wildlife Resources manages some larger tracts of land with emphasis on maintaining and improving big game winter habitat. The Utah Division of Parks and Recreation also manages a state park at Minersville Reservoir.

WATERSHED MANAGEMENT

Watershed management on public lands is concerned with the judicious use of all resources. Any one land use can and does effect the hydrologic characteristics of the respective watershed. Such characteristics are influenced by storm intensity and distribution, topography, slope, soils and amount of ground cover.

Range seeding, improved livestock management, proper road and trail alignment and stabilization, and rehabilitation of disturbed mining areas are of primary concern in protecting watershed values.

Presently the Bureau of Land Management has initiated watershed studies on all public domain lands to ascertain the present erosion condition of watersheds. These will be classified as stable, slight, moderate, critical, or severe conditions. This same information will be used to determine watershed priorities as well as the complexity of the problem.

Watershed protection land treatment measures accomplished on National Forests are listed below:

Chalk Creek Watershed (1962-1966)	
Contour trench	1,667 acres
Sagebrush spray and seed	899 acres
Broadcast seed	344 acres
Dixie harrow and seed	589 acres
Protection fence	2½ miles
Corn Creek Watershed (1961-1966)	
Contour trench	570 acres
Dixie harrow and seed	60 acres
Broadcast seed	50 acres
Gully plugs	3 miles
Dog Valley burn rehabilitation	2,405 acres
Corn Creek burn rehabilitation	220 acres
Coal Creek Watershed (1962-1964)	
Contour trench	139 acres
Seeding only	30 acres
Protection fence	½ miles
Shoal Creek Watershed (1967)	
Contour trench	2 acres
Burn rehabilitation	600 acres

Although considerable range seeding, brush control and other land treatment has been accomplished on private lands, virtually none has been applied specifically for watershed protection and management.

CROPLAND

Approximately 3.7 percent of the Basin and 18.4 percent of the private lands, totaling 195,610 acres, are presently classified as cropland.

Generally, croplands lie on alluvial fans, lake terraces and flood plains adjacent to streams. However, considerable irrigated cropland is in the Escalante Desert and some other desert valleys where water is available from ground water developments. Land use on cropland by watersheds was summarized from the land use inventory (Table 19). Detailed description and mapping of cropland is given in the "Water Related Land Use Inventory", a supplement to this appendix.

CROPPING PATTERNS

The existing cropping pattern is expected to continue essentially unchanged in the future. Climate, water supply, and soils limit the type of crops that can be grown. Future agricultural programs and imported water could change the patterns and increase irrigated acreages to some extent.

Irrigated land includes acreages where irrigated crops were grown within the last five years. Of the total cropland, 58.8 percent or 115,220 acres is irrigated cropland. Cropping patterns on irrigated cropland for 1965 are shown in Table 19 and on Figure 2.

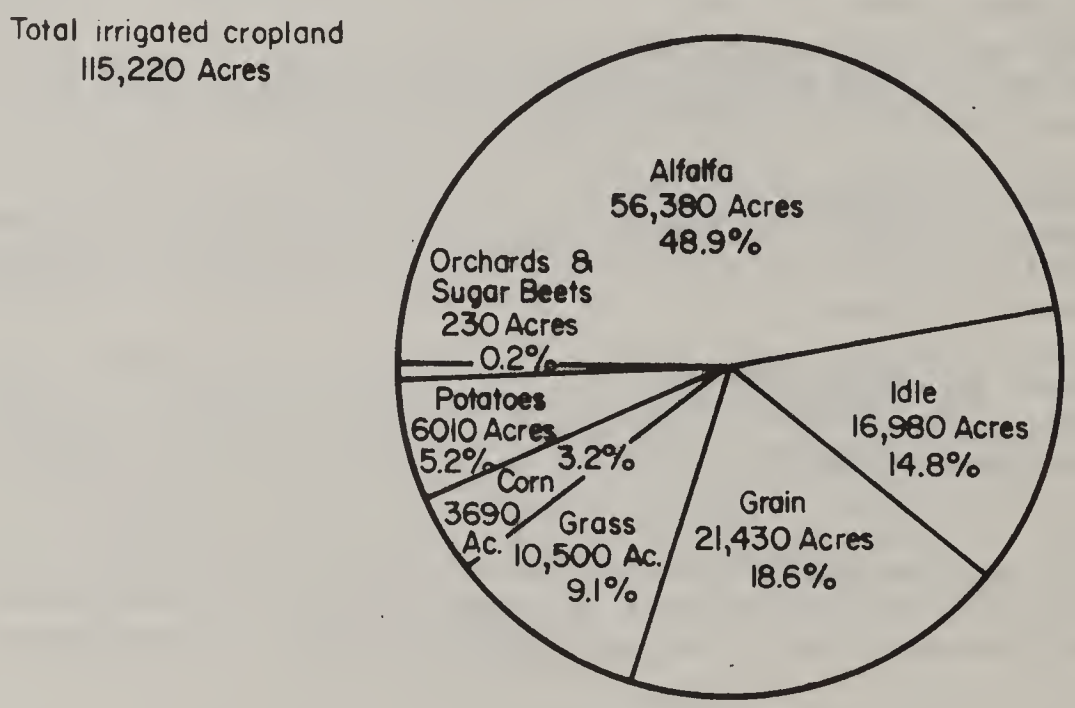


Figure 2: Land use on irrigated cropland, Beaver River Basin, 1965

TABLE 19.--Land use on cropland, Beaver River Basin, 1965

Watershed and subbasin		Irrigated cropland									Nonirrigated cropland						
		Row crops				Small grain[a]	Alfalfa	Grass[b]	Idle[c]	Subtotal	Small grain[a]	Grass[b]	Fallow	Conservation used[d]	Idle[e]	Subtotal	Total
Number	Name	Corn	Potatoes	Sugar beets	Orchard	Acres											
2-1	Sevier Lake	0	0	0	0	0	90	0	20	110	0	0	0	0	0	0	110
2	Sevier Lake	0	0	0	0	0	90	0	20	110	0	0	0	0	0	0	110
2A-19	Tintic	0	0	0	0	0	0	0	0	0	520	1,650	520	0	1,670	4,360	4,360
2A-24	Chalk Creek	340	100	0	10	4,110	8,660	1,070	2,340	16,630	3,360	5,120	4,060	4,590	1,610	18,740	35,370
2A-25	Corn Creek	260	0	0	0	2,380	7,500	1,400	1,030	12,570	4,100	4,700	6,430	1,530	2,070	18,830	31,400
2A	Fillmore	600	100	0	10	6,490	16,160	2,470	3,370	29,200	7,980	11,470	11,010	6,120	5,350	41,930	71,130
2B-1	Beaver	90	0	0	20	620	5,340	4,780	130	10,980	0	100	100	20	2,250	2,470	13,450
2B-2	Wildcat Creek	0	0	0	0	190	1,100	230	130	1,650	0	0	60	60	1,040	1,160	2,810
2B-3	Minersville	740	660	0	0	2,490	9,280	390	5,300	18,860	10	0	410	0	670	1,090	19,950
2B-4	Milford	10	10	0	0	70	230	0	270	590	0	0	80	70	0	150	740
2B-5	Cove Creek	0	0	0	0	120	180	0	0	300	0	850	40	720	0	1,610	1,910
2B-6	Black Rock	0	0	0	0	10	70	20	70	170	0	0	0	0	0	0	170
2B-7	Jacobs Well	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B	Beaver-Milford	840	670	0	20	3,500	16,200	5,420	5,900	32,550	10	950	690	870	3,960	6,480	39,030
2B1-1	Coal Creek	720	10	0	0	2,040	7,700	720	2,020	13,210	150	610	1,360	1,790	3,010	6,920	20,130
2B1-2	Green's Lake	10	0	0	0	10	180	90	50	340	20	20	0	0	250	290	630
2B1-3	Red Creek	180	30	0	0	1,660	4,200	670	1,290	8,030	250	750	890	4,510	3,460	9,860	17,890
2B1-4	Quichapa Creek	150	0	0	0	620	860	380	960	2,970	20	860	660	1,960	1,710	5,210	8,180
2B1-5	Rush Lake	0	0	0	0	0	20	180	60	260	0	0	0	0	40	40	300
2B1-6	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B1	Cedar-Parowan	1,060	40	0	0	4,330	12,960	2,040	4,380	24,810	440	2,240	2,910	8,260	8,470	22,320	47,130
2B2-1	Pinto Creek	820	350	130	0	770	1,790	430	1,490	5,780	30	220	470	0	1,180	1,900	7,680
2B2-2	Shoal Creek	90	1,950	10	0	1,550	1,150	80	290	5,120	140	570	110	60	860	1,740	6,860
2B2-3	Beryl	280	2,900	50	10	4,790	8,030	60	1,530	17,650	0	70	570	0	5,380	6,020	23,670
2B2-4	Big Hollow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B2-5	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B2	Escalante Desert	1,190	5,200	190	10	7,110	10,970	570	3,310	28,550	170	860	1,150	60	7,420	9,660	38,210
	Totals	3,690	6,010	190	40	21,430	56,380	10,500	16,980	115,220	8,600	15,520	15,760	15,310	25,200	80,390	195,610

[a]Primarily wheat and barley

[b]Hay and pasture.

[c]Includes 44.5 percent idle more than three years.

[d]Primarily grass which is not harvested.

[e]Includes 78 percent idle more than three years.

Alfalfa is the major crop grown and is harvested primarily for hay. Some alfalfa seed is harvested and late-season grazing is realized in some areas. Small grains, mostly wheat and barley, are second in acreage grown. Some grain is processed and used for livestock feed, but most is sold as a cash crop. Several species of grass are grown and used primarily for pasture although some is used for hay or seed production. Corn is grown for silage but is limited in some areas by short growing seasons. Potatoes and sugar beets are cash crops grown mainly in the Escalante Valley. Orchards are not a significant crop.

Some irrigated cropland is idle. About 45 percent of the idle land has been idle for more than three years and produces only limited pasture. The remainder is temporarily idle. It is usually in rotation with crops previously discussed and is generally bare most of the year.

A limited amount of aftermath grazing is obtained from irrigated cropland. There is some wildlife use; however, uses other than for crop production are minor.

About 41.2 percent of the total cropland, or 80,390 acres is non-irrigated (Figure 3). More than 50 percent of the nonirrigated cropland and about 85 percent of the Basin's nonirrigated small grain production is in the Fillmore subbasin. Nonirrigated small grains have been largely uneconomical in other subbasins due to low precipitation. Wheat and barley are the main small grain crops grown.

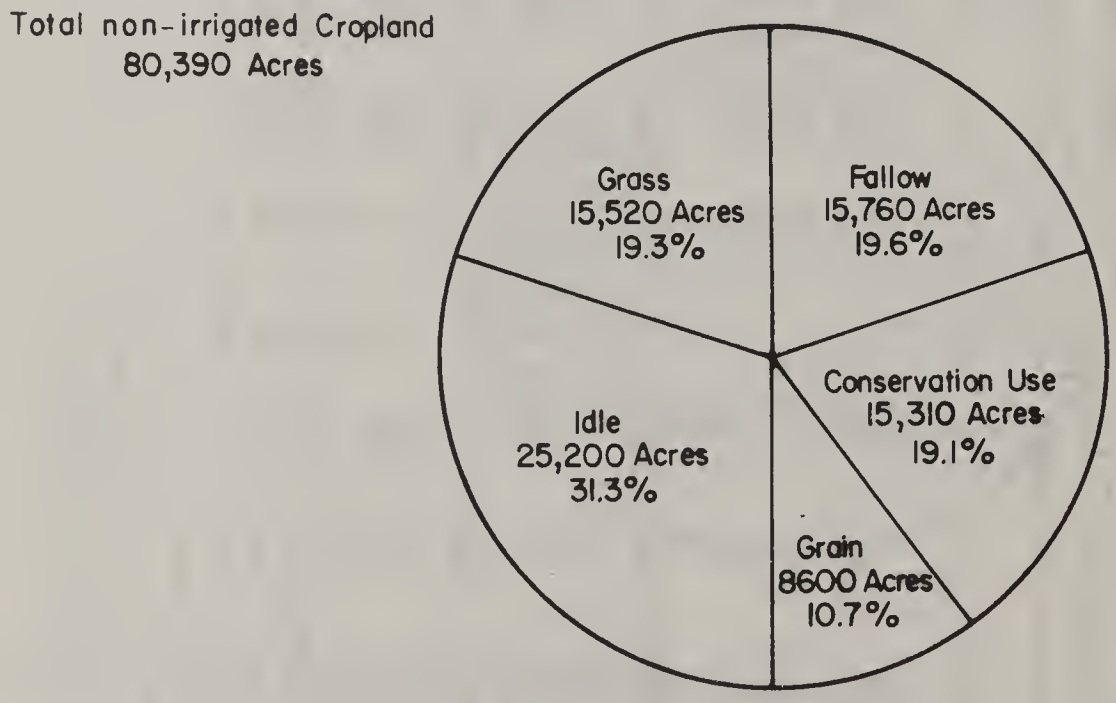


Figure 3: Land use on non-irrigated cropland, Beaver River Basin, 1965

Grasses grown on nonirrigated cropland are used mainly for pasture, but some are harvested for hay or seed. Occasionally the stands are improved by preparing a seedbed or applying other measures.

Much of the nonirrigated cropland has been set aside for conservation uses and grasses, legumes, or small grains are grown, but are not harvested.

Small grains are grown on an alternate-crop and fallow system. During the fallow year the land is generally plowed in the spring, weeded during the summer and seeded in the fall. This allows water received one year to be stored for the next year's crop.

About 31 percent of nonirrigated cropland is idle; 22 percent of this is temporarily idle and has produced a crop at least one year out of three. The idle land was formerly cropped and has not been purposely converted for another use although some of it provides pasture. A minor amount of grazing and hunting occurs on nonirrigated cropland.

ON-FARM LAND TREATMENT

Significant amounts of land treatment have been applied on cropland. The application of conservation measures makes possible proper use and management. On-farm land treatment is being applied at a near constant rate. No significant Basin-wide trends in types of treatment are apparent except for an increase in sprinkler system installation and a decrease in land leveling. Factors effecting the amount of land treatment applied from year to year include availability of funds and services from various public agencies and programs, fluctuating water supplies, agricultural production, price levels, and individual financial conditions. Generally, the most economical land treatment measures have already been applied, but needs still exist.

Irrigated Cropland

Six conservation practices constitute the majority of the mechanical land treatment applied to irrigated cropland. The existing (1965) levels of on-farm land treatment measures are shown in Table 20.

The amounts of these six conservation practices projected to be applied on irrigated cropland by 1980 under existing or going programs are shown in Table 21. These projections are based on past trends and assume the trends will continue over the projected period.

TABLE 20.--Existing on-farm treatment measures on irrigated cropland, Beaver River Basin, 1965

Conservation practice	Unit	Subbasin: Sevier: Lake	Beaver-: Fillmore	Cedar-: Milford	Escalante: Parowan	Escalante: Desert	Total
Field ditch	Miles	--	149	204	81	100	534
Land leveling	Acres	--	14,500	12,400	10,700	13,200	50,800
Ditch lining	Miles	--	49	38	28	59	174
Pipelines	Miles	--	13	19	5	15	52
Irrigation structures	Number	--	7,300	6,600	2,600	3,000	19,500
Sprinkler systems	Acres	--	1,100	700	600	700	3,100

TABLE 21.--Projected on-farm treatment measures on irrigated cropland, Beaver River Basin, 1980

Conservation practice	Unit	Subbasin: Sevier: Lake	Beaver-: Fillmore	Cedar-: Milford	Escalante: Parowan	Escalante: Desert	Total
Field ditch	Miles	--	188	219	113	138	658
Land leveling	Acres	--	19,000	18,100	13,800	17,250	68,150
Ditch lining	Miles	--	93	123	39	80	335
Pipelines	Miles	--	46	30	22	42	140
Irrigation structures	Number	--	13,750	16,600	5,600	7,500	43,450
Sprinkler systems	Acres	--	4,500	3,700	3,900	4,700	16,800

Field ditches convey water from the source of supply (usually a larger ditch or canal) to a field or fields within the farm distribution system. Land leveling is used to reshape the land surface to planned grades to allow better water distribution and minimize erosion. Ditch lining consists of installing an impervoius material (usually concrete) in an existing or newly constructed irrigation field ditch to reduce seepage losses, operation and maintenance costs, right-of-way requirements and failure hazards. Pipelines are a form of ditch lining used extensively for irrigation systems. Irrigation structures are installed as part of an irrigation conveyance and distribution system to provide better water control and distribution. Sprinkler systems are usually installed on land where surface systems are not adaptable due to steep slopes, shallow soil depths, uneven topography, gravelly or rocky soils, and small irrigation streams, and to increase irrigation efficiencies. Sprinkler systems include all necessary facilities for efficient application of water.

Land leveling is not needed where sprinkler systems are used. Land leveling or sprinkler systems have been applied on approximately 47 percent of the irrigated cropland.

Additional conservation practices include regulating reservoirs and drains. These were not evaluated since the number on the land was small and the overall impact on use and management is slight.

The rate of application in the Fillmore subbasin has been fairly constant with a slight decrease in ditch lining and land leveling, but an increase in sprinkler system installation. In the Beaver-Milford subbasin, the land treatment application rate has been erratic with the only apparent trend being an increase in sprinkler system application. The rate of land treatment application in the Cedar-Parowan and Escalante Desert subbasins has been steady with a definite decrease in land leveling and ditch lining and an increase in sprinkler system and pipeline installation.

Nonirrigated Cropland

Land treatment on nonirrigated cropland is limited mainly to the Fillmore subbasin since about 90 percent of the harvested acreage is in this area. Presently (1965), about 3,000 acres are being cultivated on the contour, and about 2,500 acres are receiving stubble mulching or other measures to utilize crop residue and control erosion. Stripcropping and terracing are practically nonexistent throughout the Basin. This is due mainly to the limited acreage, but is due also to the conversion of land to conservation use and pastures. Land treatment application rate on nonirrigated cropland by 1980 is estimated to be slightly less than the application rate in 1965.

About 2,500 acres of new contour farming and 2,200 acres of new stubble mulching are projected by 1980. These projections are based on past trends and assume the trends will continue through this period. Some land will be taken out of conservation use, but other land will be diverted to such use so that the cultivated acreage will remain essentially constant.

GRAZING LAND

The first livestock to use the Basin's range resources were horses brought by early Spanish explorers. It is believed that descendants of these original Spanish mustangs still roam these ranges. Later as mining camps were established in the early 1840's, horses and burros escaped and established themselves in the Basin and on the adjoining ranges.

The "forty-niners" and other immigrants used the "Old Spanish Trail", which passes through the Basin, to reach California. This route was favored by many because it avoided the high Sierra Nevada Mountains. Wagon trains depended on the abundant forage near Enterprise to fatten their livestock before continuing west across Nevada. Mountain meadows near the historic towns of Pinto and Hamblin on this trail were especially favored as lay-over areas to condition livestock. They were severly overused. Large gullies developed in the wet meadows and lower water tables beyond the reach of native sedges and grasses. Meadow grasses then died enabling deep rooted rabbitbrush to become established. Juniper, sagebrush, greasewood and rabbitbrush stands invaded grasslands and have become more dominant in many areas. In the desert areas, winterfat (white sage) was once extensive. This preferred forage for wintering sheep is now less abundant due to grazing.

When the area was colonized by Mormon settlers during the 1850's, livestock were grazed on the surrounding ranges on a year around basis. Small breeding herds were rapidly expanded. Grazing was free to everyone. Later capital from foreign countries and the eastern United States created a climate of livestock speculation. Large transient herds of sheep and cattle competed for the best feed. Rangelands were overused early in the spring, year after year, and forage deteriorated.

National Forests were established in 1905 and by 1910 the "forest reserves" were divided into grazing allotments. Most public domain was not brought under management until after 1934 with the passage of the Taylor Grazing Act and the subsequent establishment of grazing districts.

Since this historical period, range management practices and revegetation have resulted in higher levels of productivity on many areas. However, on other areas, topsoil has been lost and the productivity of these lands will be limited for generations.

RANGELAND CHARACTERISTICS

Rangelands include areas of native vegetation or introduced forage species grazed by domestic livestock. Cultivated areas and irrigated pasture were not considered as rangeland. The productivity, suitability and condition of rangelands vary greatly. The Natural Resources Appendix describes vegetation and soil characteristics; this section discusses productivity and range condition.

Productivity

Forage production varies greatly between types of vegetation, range condition and between favorable and unfavorable years. Range in fair condition produces 50 to 80 percent as much forage as range in good condition. Range in good condition in unfavorable years produces about 40 to 70 percent as much forage as similar range in favorable years.

Range Conditions

Range condition refers to the present state of vegetation in relation to its potential. The potential varies with the site. Much of the Basin's rangeland is in poor condition, but is improving. Overall, the Basin's rangeland rates 3 percent excellent, 7 percent good, 63 percent fair, 26 percent poor and 1 percent very poor.

Suitability

Suitability is defined as the capability of the land for livestock grazing. Suitability of land for livestock is determined by such factors as steepness of slopes, distance to water, erosiveness of soils and potential production. The kind of livestock involved also influences suitability; some lands not suitable for cattle grazing can be used by sheep without damage. These factors are variable throughout the Basin. Mountain ranges with rough topography cause cattle to concentrate and overuse creek and valley bottoms while under-utilizing steeper slopes. Cattle seldom graze more than a mile from water in rough terrain and 2 to 3 miles in flat country. Valley bottoms and alluvial transition lands with more gentle topography, sustain less resource damage from concentrations of livestock. Rangeland suitable for cattle grazing on National Forests is shown in Table 22. Rangeland suitable for livestock grazing on public domain is shown in Table 23.

LIVESTOCK MANAGEMENT

Public lands are divided into grazing allotments. The capacity of each allotment is determined from its forage productivity and suitability for grazing. Stockmen are responsible for management of the animals on rangeland within the framework of cooperative plans formulated with land managing agencies. Some livestock graze on public domain, some on National Forest and some on both lands. Coordination is needed so that the timing and amount of grazing are evaluated annually and adjusted to the capacity of the range and the needs of the rancher.

Management of sheep follows a general pattern of winter grazing on public domain, spring and fall grazing on private land and summer grazing on the National Forest. Most of the sheep that winter on the public domain within the Basin, are grazed outside the Basin during other seasons. Sheep on winter range are fed supplements such as cottonseed cake. Most cattle are confined in feedlots during the winter.

Management systems are designed to provide a maximum amount of grazing while maintaining or improving the condition of the range. Such management systems often require fencing to divide allotments into management units, and water development to permit better distribution of livestock.

Many allotments have areas that mature later in the year than others and require a seasonally deferred system of management. Some allotments must be grazed while water is available. Sheep are usually controlled as a band and managed in relation to forage condition. Grazing systems are designed to meet the phenological and physiological needs of the indiginous plant species. The Bureau of Land Management, Soil Conservation Service, and Forest Service are working together to coordinate management plans, particularly in areas where there is an irregular land pattern.

TABLE 22.--Rangeland suitable for cattle grazing on National Forests, Beaver River Basin, 1965

Subbasin	Suitable and grazed	Suitable but not grazed	Not suitable but grazed	Not suitable and not grazed	Closed to grazing	Timber and bare rock not suitable for grazing
	Percent					
2A Fillmore	29	8	34	19	3	7
2B Beaver-Milford	18	33	7	10	1	31
2B1 Cedar-Parowan	28	2	33	9	1	27
2B2 Escalante Desert	14	12	69	3	1	1
Average	26	16	25	12	2	19

TABLE 23.--Rangeland suitable for all classes of livestock on public domain, Beaver River Basin, 1965

Subbasin	Suitable and grazed	Suitable but not grazed	Not suitable but grazed	Not suitable and not grazed	Closed to grazing	Timber and bare rock not suitable for grazing
	Percent					
2 Sevier Lake	86	2	3	8	--	1
2A Fillmore	89	2	3	2	--	4
2B Beaver-Milford	92	2	4	1	--	1
2B1 Cedar-Parowan	75	2	8	7	1	9
2B2 Escalante Desert	84	3	3	4	1	5
Average	86	2	4	4	--	4

PRESENT AND PROJECTED LIVESTOCK USE OF RANGELANDS

There are over 2.8 million acres of public domain rangeland. It produces about 219,000 AUMs of grazing for cattle and sheep or 56 percent of the total grazing. National Forests provide about 36,000 AUMs (9 percent), private lands about 116,000 AUMs (29 percent) and state lands about 22,000 AUMs (6 percent), as shown in Table 24 and Figures 4 and 5.

In 1967, livestockmen with base property in the Basin had 422 grazing permits on National Forests and public domain (Table 25). These permits authorized stockmen to graze 24,300 head of cattle and 85,230 sheep for 219,300 animal unit months. Actual use during this period totaled 19,920 cattle and 63,750 sheep for 164,100 animal unit months. A comparison of permitted use and actual use shows that stockmen utilized 75 percent of their permitted grazing in 1967. These 164,100 animal unit months can be compared to the 255,270 animal unit months of grazing within the basin on National Forests and public domain indicated on Table 24. Part of the 25 percent non-use results from livestockmen voluntarily withholding their livestock while range improvement programs are underway. In order to establish better forage through reseeding programs, treated range must be deferred from grazing for 2 to 3 years. Economic and other factors also may influence a permittee not to use the full capacity permitted. The opportunity of increasing actual use in relation to permitted use should be considered in development programs.

The trend for grazing on public lands has been downward. Continued impairment of forage resources and watershed conditions has resulted in reductions on National Forests up to 1960 (Figure 6). Adjustments have also been made in livestock grazing on the public domain. A comparison of 1955 and 1967 permitted use indicates reductions of about 11 percent have occurred. Most range managers believe that the application of intensive range improvement measures combined with better management will permit increases in livestock grazing.

About 80 free roaming horses and burros in some five separate bands (which vary from 5 to 25 animals per band) are located on the ranges in the Swazey Mountains, Parowan Gap, Modena and at Iron and Mud Springs near Cedar City. These horses and burros use the area year long, while other bands from areas adjoining the Basin use these ranges for shorter periods at different times of the year.

TABLE 24.--Grazing use on rangelands, Beaver River Basin, 1967

Subbasin and watershed	Public domain			National Forests			Private lands		State lands			
	Area suitable for grazing	Cattle use	Sheep[1/] use	Area suitable for grazing	Cattle use	Sheep[1/] use	Rangeland area	Total livestock use	Area leased for grazing	Total livestock use	Total area of rangeland	Total grazing use
	Acres	AUM	AUM	Acres	AUM	AUM	Acres	AUM	Acres	AUM	Acres	AUM
2-1 Sevier Lake	873,570	8,400	47,100				13,880	1,040	110,820	3,500	998,270	60,040
2A-19 Tintic	113,300	1,400	8,200				37,030	3,480	9,640	570		13,650
2A-24 Chalk Creek	620	80			2,100		26,620	5,560	3,110	390		8,130
2A-25 Corn Creek	17,630	2,500	1,200		7,300	280	39,240	8,350	7,400	960		20,590
Fillmore	131,550	3,980	9,400	52,300	9,400	280	102,890	17,390	20,150	1,920	306,890	42,370
2B-1 Beaver	55,790	5,200	4,800		4,100	520	19,020	3,830	10,480	870		19,320
2B-2 Wildcat Creek	65,090	6,100	5,700		1,700	200	13,330	2,020	5,110	480		16,200
2B-3 Minersville	158,080	15,400	14,400				21,250	3,830	18,810	1,800		35,430
2B-4 Milford	83,690	8,300	7,800				15,170	2,570	12,010	1,100		19,770
2B-5 Cove Creek	13,950	750	700		940	960	5,280	940	640	50		4,340
2B-6 Black Rock	213,870	1,200	1,200				75,570	12,410	25,460	2,300		17,110
2B-7 Jacobs Well	339,390	16,700	15,600				13,820	2,020	20,890	1,600		35,920
Beaver-Milford	929,860	53,650	50,200	74,290	6,740	1,680	163,440	27,620	93,400	8,200	499,530	148,090
2B1-1 Coal Creek	33,030	1,290	1,290		1,400	1,140	82,200	10,360	6,480	490		15,970
2B1-2 Greens Lake	1,250	50	50				3,260	410	80	10		520
2B1-3 Red Creek	96,290	3,320	3,270		2,500	280	50,630	6,070	9,140	660		16,100
2B1-4 Quichapa Creek	31,550	1,080	1,100				47,160	5,910	3,000	230		8,320
2B1-5 Rush Lake	82,260	3,190	3,200				9,670	1,370	9,800	830		8,590
2B1-6 Other	9,730	290	280						1,270	110		680
Cedar-Parowan	254,110	9,220	9,190	22,730	3,900	1,420	192,920	24,120	29,770	2,330	1,260,990	50,180
2B2-1 Pinto Creek	27,460	990	230		4,100		33,520	4,300	6,150	420		10,040
2B2-2 Shoal Creek	9,450	410	100		8,100		12,260	1,780	1,380	110		10,500
2B2-3 Beryl	333,980	13,250	3,150		390		167,320	23,430	41,710	3,100		43,320
2B2-4 Big Hollow	252,230	7,840	1,860		20		152,660	16,180	43,890	2,500		28,400
2B2-5 Other	6,060	270	0				150	20	1,740	130		420
Escalante Desert	629,180	22,760	5,340	52,170	12,610		365,910	45,710	94,870	6,260	1,142,130	92,680
Total Basin	2,818,270	98,010	121,230	201,490	32,650	3,380	839,040	115,880	349,010	22,210	4,207,810	393,360

1/ Animal unit months include both sheep and cattle on the basis of five sheep months per one cattle month.

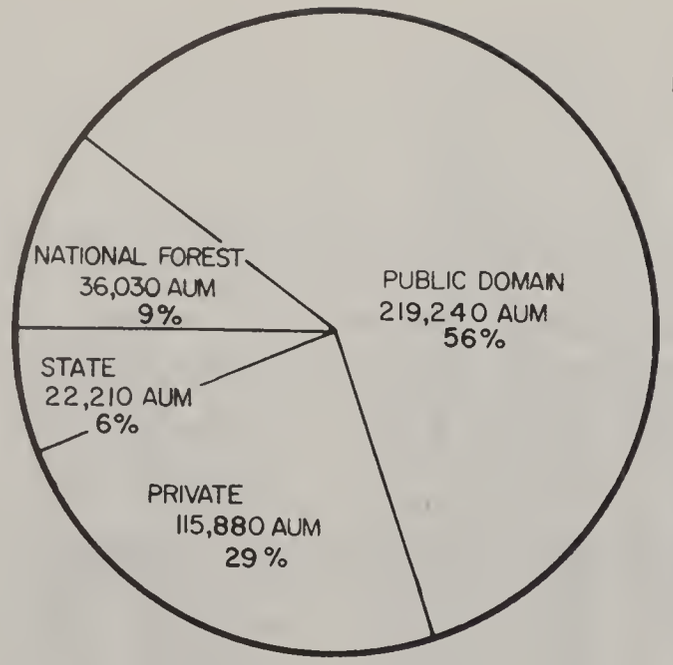


Figure 4:
Livestock grazing on rangelands, 1967, Beaver River Basin

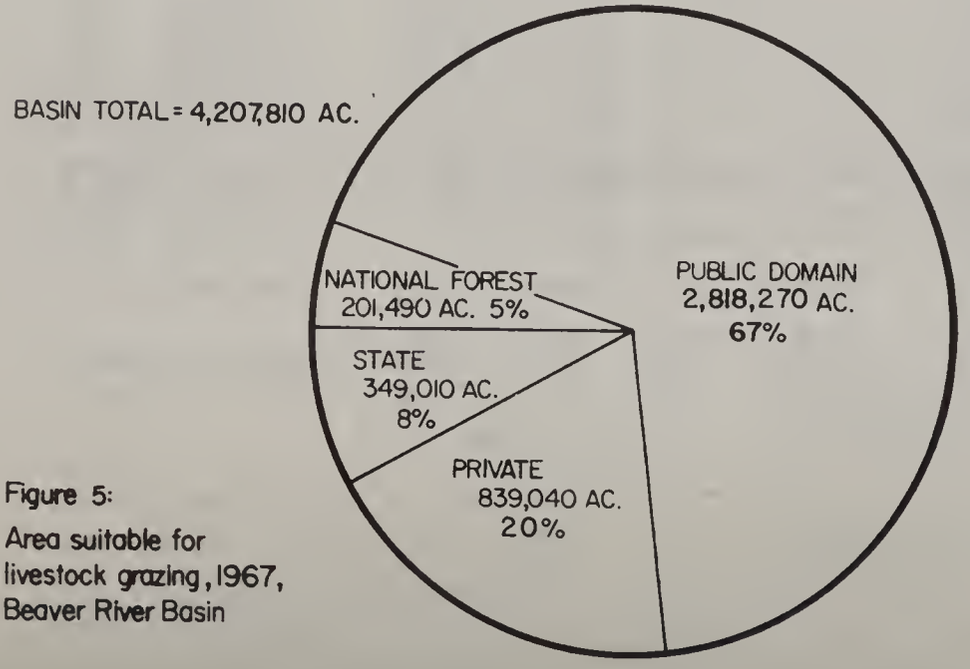


Figure 5:
Area suitable for livestock grazing, 1967, Beaver River Basin

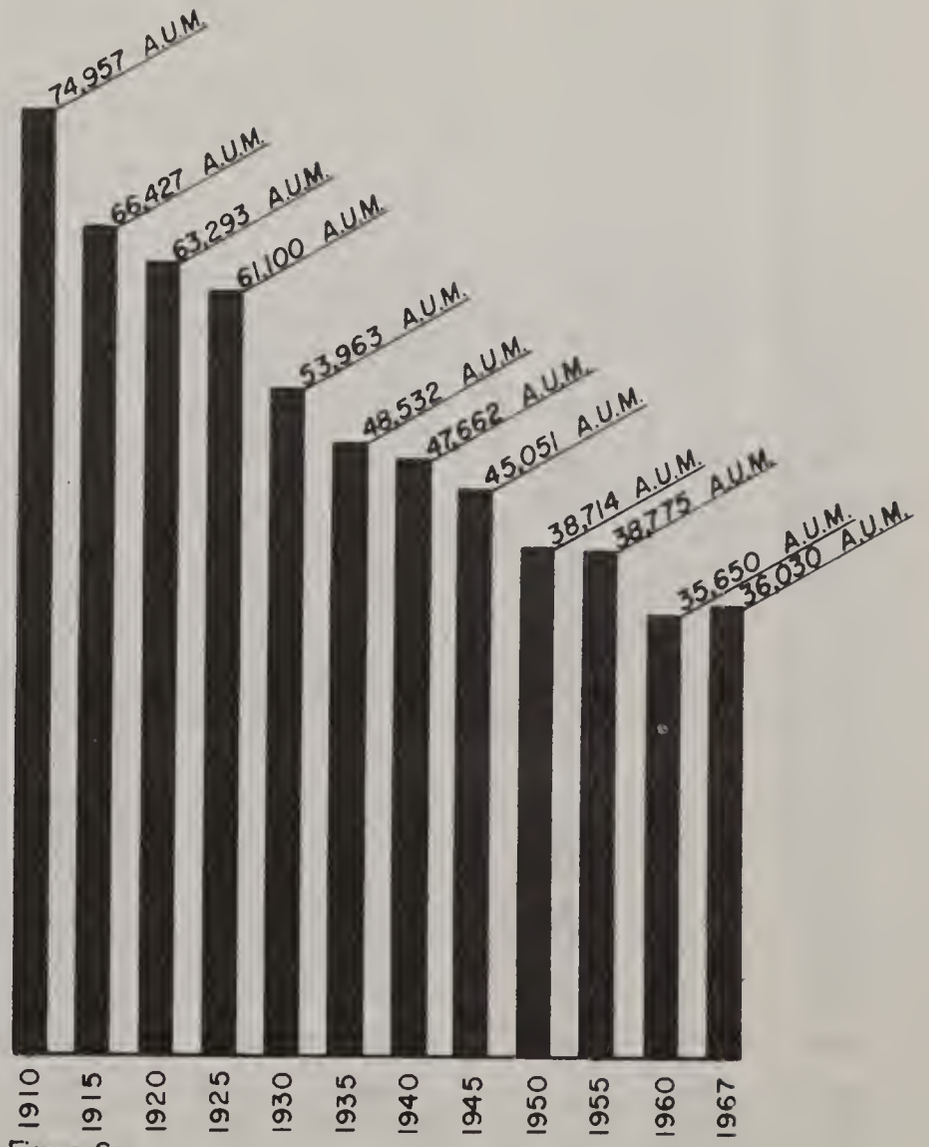


Figure 6:
Grazing in Animal Unit Months[△] on National Forests Beaver River Basin 1910 to 1967.

[△]Animal Unit Months include both sheep and cattle on the basis of five sheep months per one cattle month.

TABLE 25.--Permitted grazing[a] and actual use by cattle and sheep on public domain and National Forests Beaver River Basin, 1967[b]

CATTLE

Subbasin	Permit holders	Size of permits		Actual use		Comparison of actual to permitted AUM use
	Number	Number	AUMs	Number	AUMs	Percent
2A Fillmore	67	5,097	31,477	4,727	28,826	91.5
2B Beaver-Milford	116	7,446	36,011	6,833	33,006	91.6
2B1 Cedar-Parowan	119	8,922	61,413	5,989	38,644	62.9
2B2 Escalante Desert	35	2,833	22,228	2,371	18,432	82.9
Basin total	337	24,298	151,129	19,920	118,908	78.6

SHEEP

Subbasin	Permit holders	Size of permits		Actual use		Comparison of actual to permitted AUM use
	Number	Number	AUMs	Number	AUMs	Percent
2A Fillmore	4	16,129	18,354	14,495	17,438	95.0
2B Beaver-Milford	-	-	-	-	-	-
2B1 Cedar-Parowan	79	68,754	48,788	48,799	27,237	55.8
2B2 Escalante Desert	2	850	1,071	460	510	47.6
Basin total	85	85,733	68,213	63,754	45,185	66.2
Grand total	422	110,031	219,342	83,674	164,093	74.8

[a] Permitted grazing may or may not be within the Basin.
[b] Use by livestockmen with base property within the Basin. Based on interviews of livestockmen who resided within the Basin.

A study[1] within the Beaver County Soil Conservation District, identified many aspects of farm and ranch operations. This information is felt to be descriptive of operations throughout most of the Beaver River Basin. This study showed that between 1940 and 1964, sheep declined 54 percent and cattle increased 149 percent. The largest decrease (57 percent) in sheep numbers occurred in Beaver County in the five-year period 1940 to 1945 as shown in Table 26. The typical size of a range-beef operation was about 100-breeding cows. The base property includes 200 acres of crop and pasture land that produced 40 percent of the forage requirements. The rancher obtained an additional three percent of his livestock forage from other private rangeland, 46 percent from public domain, five percent from National Forests and the remaining six percent from purchased feed.

TABLE 26.--Sheep and cattle on ranches in Millard, Beaver and Iron Counties[a], Beaver River Basin, 1940-1964

	Millard		Beaver		Iron		Total	
Year	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep	Cattle
1940	37,534	20,603	18,712	10,715	179,425	8,084	235,671	39,402
1945	31,557	39,245	8,084	14,087	147,628	12,501	187,269	65,833
1950	14,111	36,637	2,346	16,816	78,056	13,802	94,513	67,255
1954	20,989	53,570	1,053	20,306	109,687	19,866	131,729	93,742
1959	23,291	52,123	9,168	20,532	88,833	16,680	121,292	89,335
1964	22,687	57,303	5,615	19,898	79,152	21,090	107,454	98,291

[a]Figures are for counties and not areas just within the Basin. They include farm as well as range livestock.

Source: U. S. Census of Agriculture.

Range Facilities

Range facilities are necessary to obtain better distribution of livestock and proper utilization of forage. Facilities include corrals, fences, and watering facilities.

Range improvements on public lands are installed through cooperative efforts of grazing permittees and land managing agencies. Existing and projected facilities on National Forests, public domain, and private lands are shown in Tables 27, 28, and 29. Existing corrals were not inventoried and the needs for additional facilities were not evaluated. On National Forests, 25 percent of the 1985 projected needs will be developed through going programs.

[1]"Economic Feasibility and Impact of Present and Potential Range Improvement Programs in the Four Corners Area,". 1969, by J. Wayne McArthur.

TABLE 27.--Existing and projected range facilities and forage improvement on National Forests, Beaver River Basin, 1965 and 1985

Subbasin	Range Facilities						Forage improvements	
	Livestock reservoirs		Troughs, wells pipelines		Fences			
	1965	1985	1965	1985	1965	1985	1965	1985
	Number	Number	Number	Number	Miles	Miles	Acres	Acres
2A Fillmore	10	19	52	58	101	110	866	3,354
2B Beaver-Milford	13	15	21	32	97	105	4,368	8,400
2B1 Cedar-Parowan	12	16	13	17	52	57	1,400	1,800
2B2 Escalante Desert	100	110	29	35	133	148	10,581	18,855
Basin total	135	160	115	142	383	420	17,215	32,409

TABLE 28.--Existing and projected range facilities and forage improvement on public domain, Beaver River Basin, 1970 and 1985

Subbasin	Range Facilities										Forage improvement	
	Developed springs		Fences		Reservoirs		Wells		Pipelines			
	1970	1985	1970	1985	1970	1985	1970	1985	1970	1985	1970	1985
	Number		Miles		Number		Number		Miles		Acres	
2 Sevier Lake	9	10	95	140	65	76	2	15	40	100	6,700	7,000
2B Beaver-Milford	3	24	356	500	56	90	15	30	22	60	39,000	75,000
2A Fillmore	4	5	48	90	3	12	11	18	6	10	8,000	12,000
2A-19 Tintic watershed	8	15	92	125	--	10	1	2	12	24	13,900	38,500
2B2 Escalante Desert	1	3	437	553	25	40	13	24	10	19	5,950	12,500
2B1 Cedar-Parowan	-	--	254	312	17	24	7	10	10	15	23,320	29,500
Basin total	25	57	1,282	1,720	166	252	49	99	100	228	96,870	174,500

TABLE 29.--Existing and projected range facilities and forage improvement on private land, Beaver River Basin, 1965 and 1985

Subbasin	Range Facilities				Forage improvement	
	Fencing		Water development			
	1965	1985	1965	1985	1965	1985
	Acres		Miles		Number	
2 Sevier Lake	20	27	20	43	75	195
2A Fillmore	165	244	210	474	735	1,625
2B Beaver-Milford	125	196	195	433	18,480	22,680
2B1 Cedar-Parowan	190	266	240	495	14,060	19,220
2B2 Escalante Desert	330	558	340	720	26,580	36,200
Basin Total	830	1,291	1,005	2,165	59,930	79,920

Forage Improvement

Many means are utilized to increase rangeland forage or to make existing forage more palatable. Plant species differ in nutritive content, in their palatability and in their ability to hold soil in place. Most grass species have desirable characteristics; forage improvement is usually aimed at maximizing grasses on cattle range. Forbs and browse provide important forage for sheep and a balanced habitat for wildlife; therefore, a balance is encouraged when ranges are used both for livestock and wildlife. Proper livestock management is generally the most effective way to improve and maintain range condition.

Mechanical and chemical means, combined with seeding, are commonly used to supplement native species under management by reducing less desirable vegetation and to enable seeded or native grasses to become established. Mechanical treatment has been successful. Complete removal of sagebrush or pinyon-juniper and plowing or other intensive seedbed preparation is seldom necessary or economically justified on rangeland.

Increased productivity resulting from forage improvement measures have been remarkable. Increases of three to five times the current production under favorable climatic conditions, are common. There have been very few failures in efforts to improve forage where rainfall exceeds 10 inches annually and soils are deep and well drained. Efforts to seed saline soils and seeding in areas of low precipitation have been attempted experimentally without much success. On a major part of the Basin, seeding or other forage improvements is not practicable at this time. Projected livestock grazing resulting from forage improvement is shown in Table 30.

Projected (1985) increases in livestock grazing are based on a continuation of forage improvement programs at current levels of accomplishment as indicated by Tables 27, 28, and 29. This is exclusive of improved range management. Improved management would permit additional grazing beyond that shown. On National Forests, the 1967 grazing use is projected to increase to 38,170 AUMs or 6 percent. On public domain, the 1967 grazing use is projected to increase to 224,000 AUMs or 2 percent. Private land grazing is expected to increase to 123,150 AUMs or 6 percent. Basin-wide grazing capacity resulting from a continuation of going programs could provide 407,222 AUMs of grazing by 1985 compared to 393,360 AUMs at present, an increase of about 3.6 percent as a result of forage improvement programs. Good grazing management is a necessity to insure the success of any forage improvement program.

TABLE 30.--Projected livestock grazing resulting from forage improvement through going programs on National Forests, public domain, and private lands, Beaver River Basin, 1985

Subbasin	Current stocking rates	1985 stocking rates after treatment	Area of forage improvement under going programs (1985)	Net increase in annual grazing capacity	Present grazing (1967)	Projected 1985 grazing
	AUM/A.	AUM/A.	Acres	AUM	AUM	AUM
National Forest						
2A Fillmore	0.185	0.339	2,488	384	9,680	10,064
2B Beaver-Milford	0.113	0.339	4,032	911	8,420	9,331
2B1 Cedar-Parowan	0.234	0.339	400	42	5,320	5,362
2B2 Escalante Desert	0.242	0.339	8,274	803	12,610	13,413
Basin total			15,149	2,140	36,030	38,170
Public Domain						
2 Sevier Lake	0.064	0.060	300	0	55,500	55,500
2A Fillmore	0.102	0.147	28,600	1,287	13,380	14,667
2B Beaver-Milford	0.112	0.195	36,000	2,988	103,850	106,838
2B1 Cedar-Parowan	0.073	0.111	6,180	235	18,410	18,645
2B2 Escalante Desert	0.045	0.083	6,550	250	28,100	28,350
Basin total			77,630	4,760	219,240	224,000
Private						
2 Sevier Lake	0.075	0.275	120	24	1,040	1,064
2A Fillmore	0.169	0.480	890	277	17,390	17,667
2B Beaver-Milford	0.169	0.523	4,200	1,488	27,620	29,108
2B1 Cedar-Parowan	0.125	0.480	5,160	1,830	24,120	25,950
2B2 Escalante Desert	0.125	0.472	9,620	3,343	45,710	49,053
Basin total			19,990	6,962	115,880	122,842

FOREST PRODUCTS

Forest products harvested annually include 1,560,000 board-feet of sawtimber, 15,570 posts, 1,760 poles, 100 cords of firewood, 2,750 Christmas trees, 19 ornamental trees, and 1,300 pounds of pinyon nuts (Table 31). About 94 percent of the sawtimber is harvested in the Beaver Creek watershed and is usually shipped outside the Basin to Panguitch, Utah for processing.

TABLE 31.--Average annual forest products harvested, Beaver River Basin, 1963-1967[a]

Product	Saw-timber	Posts	Poles	Fire-wood	Christmas trees	Orna-mental	Pinyon nuts[b]
	Mbm[c]	Each	Each	Cords	Each	Each	Lbs.
National Forests							
Juniper		7,730				5	
Subalpine-fir	60		20		460		
Aspen				50			
Engelmann spruce	1,460	140	1,740		1,041	12	
Pinyon pine					310	2	
Douglasfir	40						
Total	1,560	7,870	1,760	50	1,811	19	
Public domain							
Juniper		7,700					
Pinyon pine				50	700		1,300
Total		7,700		50	700		1,300
State lands							
Pinyon pine					240		
Total all lands	1,560	15,570	1,760	100	2,751	19	1,300

[a]No information available on private lands.

[b]Harvest includes only commercial operations, many additional pounds are collected by recreationists.

[c]One thousand feet - board measure.

There are 95,080 acres or 1.8 percent of the area growing conifer trees. Much of this area is inaccessible or is producing trees of non-commercial quality. Only a small portion of this timber land is capable of producing sawtimber on a sustained-yield basis. If lack of access and other constraints could be overcome, the relationship of harvest to annual allowable cut indicates a potential for increased utilization of forest products (Table 32).

TABLE 32.--Relationship of regulated average annual allowable timber harvest to average annual actual harvest on National Forests, Beaver River Basin, 1963-1967

Subbasin	Species	Annual allowable	Actual annual harvest	Percentage harvested
		Mbm[a]	Mbm[a]	Percent
2A Fillmore	Aspen	273	0	0
2B Beaver-Milford	White fir	473	20	4
	Alpine fir	672	42	6
	Engelmann spruce	2,506	1,406	56
	Aspen	1,930	0	0
2B1 Cedar-Parowan	White fir	15	0	0
	Alpine fir	10	0	0
	Engelmann spruce	100	94	94
	Aspen	10	0	0
Total		5,989	1,562	26

[a]One thousand feet - board measure.

Pinyon-juniper woodlands represent 1,311,460 acres or 25 percent of the total land area. These Pinyon-juniper woodlands are also beginning to play an ever increasing role in programs concerned with environmental quality and open-space values. Forest products harvested from these woodland sites include pinyon Christmas trees, cordwood, fence posts and pine nuts. With the exception of Christmas trees, the majority of Pinyon-juniper products are utilized within Utah. The increased public awareness of these woodland areas is evident by the fact that authorized free use for Christmas trees, fuel wood, fence post and pine nuts is equal to and in some years exceeds the amount of products sold to commercial operators. Increased emphasis should be placed on managing Pinyon-juniper areas on high quality sites in order to meet the increased demand for commercial and free-use products.

At Summit, a private landowner is growing Christmas trees on a small plot of irrigated land. The success and profitability of this small venture indicates that there is a potential for Christmas tree plantations.

There are two small forest-based industries. At Cedar City, an excelsior plant annually converts about 3,000 to 5,000 tons of aspen to shredded wood (excelsior). Most of the aspen is obtained outside the Basin. The excelsior is formed into 70-pound bales, which are marketed in southern California. Excelsior is used as packing material for melons, industrial products and the manufacture of cooling pads in air conditioners. A small sawmill, also at Cedar City, produces about 100,000 board feet of lumber annually.

FIRE, INSECT AND DISEASE PROTECTION

Protecting vegetation from fire, insects and disease is an important aspect of land management. The extent of these problems is described in Appendix III, Resource Related Problems. The Forest Service is responsible for fire protection on National Forests. The Bureau of Land Management is responsible for protection of the public domain. The Utah Section of Forestry and Fire Control is responsible for fire protection on all other lands. There is close cooperation among these fire protection organizations. Mutual assistance among the agencies, municipalities, and counties provides an effective force in combating wildland fires. Communities of Fillmore, Beaver, Milford, Parowan, Cedar City, Escalante Valley and Enterprise have organized volunteer fire departments equipped with pumper trucks. Paragonah and Minersville have pumper trucks, but no organized fire departments.

Insect and disease surveillance is conducted annually by the Forest Service on all forested lands. Aerial surveys supplemented by ground verification checks are utilized to detect outbreaks; the virulence and extent of each outbreak is evaluated, and from this, control decisions are made. Control programs are conducted in such a manner that the impact on environment and ecology are fully evaluated.

MINING

Mining is an important use of the lands within the study area. Many of the mining districts are also popular as recreational areas for rockhounds and souvenir hunters, as historical sites, and scenic attractions. These same mining areas are subject to future exploration and development of additional mineral deposits.

The Tintic District has produced more than 1,000 tons of copper, and over 2½ million troy ounces of gold. The copper, gold, lead, zinc, and silver values total nearly $332 million.[1] During recent years production from the district has steadily declined due to high costs, low metal prices, and the problem of mining at great depth. Consolidation of mining claim ownership and operations to increase the efficiency and reduce operation costs have taken place within the district. Of the non-metallic minerals produced in the district, halloysite clay is the most important. Annual output averages nearly 60,000 tons, valued in excess of $1 million. Commercial grade deposits of silica are mined near Jericho. No production figures are available for these deposits.

Cinder (volcanic scoria) production has been 35,000 to 45,000 tons annually and is expected to continue for some time. Most of the production has come from the cinder cone west of Flowell, although Tabernacle Hill, Black Rock Volcano (near Kanosh), and the cinder cone southwest of Cove Fort have produced some cinders.

Pumice and perlite have been produced from an area east of Black Rock. The first development took place in 1897, when 158 tons were produced. The largest production has come from the Cudahy Mine; large reserves are still present. There is excellent potential for future production. Perlite has been produced from the Ranch Canyon deposit, which also contains pumicite, pumice and obsidian. Most of the perlite was used as a lightweight aggregate for plaster. Pumice and pumicite have also been produced from the Ranch Canyon and Bailey Ridge areas. The output has been used for making lightweight concrete blocks and as an abrasive.

Limestone and dolomite have been produced from the Cricket Mountains east of Sevier Lake. Most of this production was used for making lime. The lime was used for steel-making, but the quarry is inactive at present.

Travertine (tufa, Colorado marble, onyx) has been produced from a quarry southwest of Meadow, but production figures are not available. The quarry is now idle, but large amounts of material still remain.

Gypsum and gypsite have been produced intermittently from the vicinity of White Mountain, west of Meadow, for many years. It is estimated the dunes on White Mountain contain as much as 450,000 tons of gypsum. This material was mined briefly during the 1940's for use as a Portland cement retarder. It is being mined at the present time for a soil conditioner. Gypsite is earthy secondary gypsum mixed with silt, sand and clay. South of White Mountain, gypsite extends over an area of several square miles. Although many millions of tons of gypsite are present, it is useful mainly as a soil conditioner.

Tungsten was produced from the House Range deposits north of Sevier Lake during the 1951-1956 period. The value of tungsten output from this area represented 3/4 of the total mineral production for Millard County in 1955. In 1956, the House Range produced 67 percent of the total Utah tungsten production. Although some high-grade ore has been produced, the average grade was from 0.2 to 0.3 percent Tungstate (WO_3).

The fabulous Horn Silver Mine was discovered in 1875 and the San Francisco (Frisco) district west of Milford became a roaring mining camp. For many years it and adjacent districts were heavy producers of gold, silver, copper, lead and zinc, and some tungsten. Now the rich surface ores are gone, mining costs are high, and metal prices low, so the once rich-metal producing districts are idle. A notable exception is the Bawana open-pit copper mine in the Rocky District, which has produced significant quantities of copper with some gold, silver, and iron in recent years.

Uranium has been produced from three groups of claims in the Wah Wah Mountains west of Milford. These groups include the Staats, Gaus, and Desert View claims, all in the same general area. No uranium production has been reported in recent years, however.

Fluorite (fluorspar) occurs at several localities within the area and has been produced recently. Fluorspar is a valuable commodity within the area and exploration for more reserves has been active in the Needles Range, Wah Wah Mountains, and the Star Range or Shauntie Hills.

Recent drilling has been done on the Blawn Wash (Wah Wah) clay deposit and samples are presently being tested to determine if the deposit warrants development. The clay minerals present include halloysite, kaolinite, montmorillonite, and alunite. Other occurrences of clays have been found near Blawn Wash and in the Shauntie Hills. Potential development of these deposits looks promising.

Mining districts within the Mineral Range include the Lincoln, Bradshaw, Granite, North Granite, McGarry, Antelope, and Jarloose. Other districts include Newton northeast of Beaver, and Sulphurdale near Cove Fort. Metallic elements and mineral commodities include gold, silver, copper, lead, zinc, iron, molybdenum, thorium, tungsten, uranium, barium, bismuth, fluorine, and sulfur. Other commodities produced in the area include sand and gravel, volcanic cinders (scoria), pumice, pumicite, perlite, obsidian, and common opal.

Isaac Grundy, with others, built the first lead-silver recovery furnace in the west at Minersville in 1858 to produce lead for bullets. Something in the lead made it too hard for good bullets and that "something" was later found to be silver. Most of the districts produced some ore in the early days, but production figures are not available. There have been occasional shipments in the last ten years from the Lincoln, Granite, and Jarloose districts, but no significant metal production.

Extensive sulphur deposits at Sulphurdale have been worked at various times for many years. A mill was built in 1961-1962, and the first production (2,156 tons) was reported in 1965. The property was shut down in 1966 when the owner died.

Large areas in the southern part of the study area are underlain with iron deposits. Most of the commercial grade ore occurs in disconnected masses in a belt about 20 miles long and 1-1/8 miles wide, stretching from northeast to southwest along the eastern slopes of Three Peaks, Granite Mountain and Iron Mountain. Bureau of Mines geologists in 1957 estimated the Iron Mountain area reserves at 350 million tons. Of this total, 100 million tons were classified as recoverable at this time. The richest discoveries and heaviest production have been made in the Iron Springs, Iron Mountain and Pinto districts. All-time production to 1965 was 72,273,000 tons. One company completed a $1,300,000 plant at its Iron Springs open-pit mine for upgrading the low-grade ores of the area. The iron ore output is sufficient to rate Utah fourth place in iron-producing states.

Oil and gas have been found in commercial quantities, but the area is relatively unexplored for these commodities. Leasing is fairly active in the eastern part of the Basin with several thousand acres presently under lease.

About 35,000 acres of the Sevier Lake bed are currently under prospecting permits for potassium. Shallow subsurface brines in the Sevier Lake Basin are saline; about five times as saline as sea water brines. More drilling is needed before the potential supply of salines can be estimated.

The U. S. Geological Survey has classified 5,200 acres in the Roosevelt Hot Springs area northeast of Milford as a known Geothermal Resource Area. Also, approximately 830,000 acres within the study area have been classified as prospectively valuable as a geothermal resource area. This area is not in a withdrawn status, but is subject to continuing review by geological survey specialists. Leases may be issued on these lands for geothermal resources under the Geothermal Steam Act of 1970.

Coal fields are found in the Markagunt Plateau, Pine Valley Mountains and near Parowan Gap. Coal production for 1964-1965 from Iron County was 89,848 tons valued at $411,636. This coal production was primarily to fill the needs of the steam-generating plant in Cedar Canyon, but some coal is mined for local use. Approximately 7,000 acres within the study area have been classified as prospectively valuable for coal.

MISCELLANEOUS LAND USES

The lands of the Beaver River Basin are used for many purposes not previously discussed. An estimated 32,000 acres, or less than one percent of the total area is used for miscellaneous purposes such as urban, industrial, water storage and transportation facilities (Table 18).

Urban and industrial land use includes cities, towns, cemeteries, airports, golf courses, and railroad yards. Land used for water storage includes ponds, lakes, and reservoirs. Transportation facilities include trails, roads, highways and railroads. Roads and railroads within urban areas were included in the urban tabulation.

Chapter III

O U T D O O R R E C R E A T I O N

Outdoor recreation is one of the most popular and rapidly expanding uses of resources. Many new economic opportunities will be created by future growth of recreation and tourism. Rapid expansion is resulting from increases in leisure time and income levels combined with better transportation facilities. Increasing population and environmental deterioration at the more populous areas influences people to travel farther in search of quality recreation experiences.

Outdoor recreation is described in terms of present facilities, qualities that make the Beaver River Basin attractive to recreation visitors, and existing recreation use and projections.

OUTDOOR RECREATION RESOURCES AND DEVELOPMENTS

The Basin contains a diversity of recreation opportunities. This section describes many of the scenic attractions, areas of historical interest and developed facilities. The map following page 62 indicates the locations of these recreation sites. Fishing and hunting opportunities are not indicated on the map, but are popular activities throughout the Basin.

SEVIER LAKE WATERSHED

This area is characterized by rolling hills and a desert playa. Swasey Peak and Notch Peak are over 9,000 feet in elevation, rising steeply from the desert floor on the east, with an abrupt drop to the west. The House Range and Confusion Mountain Range, from Swazey Peak on the north to Crystal Peak on the south, is one of the most outstanding areas in the United States for gathering fossils of the Cambrian geologic era. The Smithsonian Institute has published many bulletins on this area and has several displays of fossils from Antelope Springs. One species of trilobite found in this area, Agnostus, is one of the very earliest forms of differentiated life, dating back to the early history of the earth.

Antelope Springs and Fossil Mountain in this same area are the most popular sites of fossil collection. There are undeveloped camp sites part way up the west side of Swazey Peak with an excellent view of Sevier Desert and Tule Valley. Also, as a side attraction there is a small cave southwest of Antelope Springs.

Sevier Lake is a lifeless desert playa, almost 30 miles long and 12 miles wide. Crystal Peak on the west edge of the subbasin is a mountain of quartzite. These attractions are presently visited by few people. Existing access is over poor dirt roads and only the more hardy desert lovers reach and appreciate this scenic area.

North of Squaw Spring below Frisco Peak lies the remnants of the historic town of Frisco. This town sheltered miners who worked the Horn Silver Mine, one of the richest mines ever operated in the State.

TINTIC WATERSHED

This watershed lies north of the conterminous Basin area. Paul Bunyan's Woodpile, on the east edge of the watershed, is a massive rock formation appearing as an immense stack of petrified cordwood all cut to stove length for some mammoth cookstove. There is one table and one toilet at the picnic site. No water is available at the site.

The Little Sahara Recreation Area in the southwest part of the watershed is the most heavily used recreation site administered by the Bureau of Land Management in the State of Utah. Over many thousands of years the wind has carried the sand from bay bars left by Lake Bonneville and deposited it in the area. The sand now covers more than 30,000 acres. This area is becoming increasingly popular with dune buggy enthusiasts.

At the present time there are 26 tables and 14 toilets at the area. There is no water. Development plans for the area include a water system, road system, camping and picnicing facilities, sanitation facilities, play areas for children, areas for competitive and general use of motorcycles and dune buggies, and a natural area for scientific study and observation of the flora and fauna. When fully developed the site will be capable of accomodating nearly 75,000 people at one time.

The Utah State Department of Highways in cooperation with the Bureau of Land Management has developed a rest area adjacent to U.S. Highway 6 and 50. At this location picnic tables, sanitation facilities, and water are provided. The north end of the Tintic area is rich in mining history and contains remnants of several mining towns.

CHALK CREEK WATERSHED

On the National Forest, four campgrounds have been developed along Chalk Creek. Copleys Cove has a capacity for 70 people; Buckskin Charlie, 15 people; Pistol Peak, 70 people; and Shingle Mill, 40 people. Picnic tables, sanitation facilities and water are provided. People are attracted to these cool canyon retreats and enjoy the esthetics of the canyon and shady riparian vegetation. To the west, a geologically recent lava flow covers an extensive area and creates a unique "moonscape."

Fillmore, the principal city, was the first capitol of Utah. Capitol buildings and many historic artifacts are displayed for visitors. A state park is operated in connection with the historic site.

CORN CREEK WATERSHED

There is a primitive campground on the National Forest on Meadow Creek with a capacity for 25 people. Adelaide Park on Corn Creek is a modern campground with flush toilets and other amenities with a capacity for 200 people.

On the west side of the watershed, partly on public domain, is an area known as White Mountain, named for the deep white beds of gypsum sand. It now serves as a favorite picnic site. This area is most popular in the spring of the year for picnicking. The site has been especially popular at Easter time when as many as 300 people have used the area. There are no facilities at the site. People are attracted to the area by the clean sand and nearby lava formations. This site is five to fifteen miles from the communities of Fillmore, Kanosh, Meadow, Flowell, and Hatton.

Near Meadow, a private ranch is catering to recreationists. Three small fishponds have been constructed and the 200-acre ranch provides opportunities for participation in rural life activities.

COVE CREEK WATERSHED

The principal attraction is the well preserved "Old Cove Fort", constructed in 1867. It is 100 feet square with walls 10 feet high. This area was considered a dangerous spot for Indian attacks as it was a common rendezvous for wandering tribes. The fort was built to protect nearby stagecoach and freightline routes and is located on what was known as the "Mormon Trail." Interstate Highway 70 from the east joins Interstate 15 near Cove Fort.

WILDCAT CREEK WATERSHED

High mountain areas in the Manderfield Reservoir vicinity are scenic attractions. Two large rest areas administered by the Utah State Highway Department adjacent to Interstate 15 have been built. They provide modern facilities, parking, water, picnicking, and sanitation to accommodate a large number of people.

BEAVER WATERSHED

The high mountains east of the city of Beaver are capped by the spectacular Tushar Peaks. Numerous reservoirs, clear streams, and alpine scenery attract many recreation visitors. National Forest campgrounds, capacity and number of units are shown in Table 33.

TABLE 33.--Campgrounds on National Forest, Beaver Watershed, Beaver River Basin, 1965

Name of site	Family units		Capacity (persons at one time)
	Camping	Picnicking	
	Number of units		Number
Little Reservoir	6	6	60
Kents Lake	12	25	185
Anderson Meadow	10	--	50
Mahogany Cove	7	--	35
Merchant Valley	2	--	10
Timid Springs	6	--	30
Lousy Jim	3	--	15
Lower City Plant	3	--	15
LaBaron Lake	-	--	15
Little Cottonwood	20	--	100
Ponderosa	--	24	120
Total	72	55	635

Other facilities include a commercial public service site (Puffer Lake Lodge), a summer home area in Merchant Valley where twelve homes have been built, and an LDS Church camp. Roads and trails provide routes for visitors giving access to many outstanding scenic views.

Existing private development includes summer home tracts on state land near LaBaron reservoir. At this location, 165 summer home lots have been surveyed and about 71 leased. Another summer home development is situated on the South Fork of the Beaver River. At the mouth of Beaver Canyon, a summer-home development is also planned; about 67 lots had been surveyed and 33 sold by 1967. Beaver City has developed a nine-hole golf course, race track, open-air swimming pool, little league ball diamond, and a small park. The Daughters of the Utah Pioneers maintain a museum and information center that is open during the summer months. Near the mouth of Beaver Canyon, a private dude ranch specializing in horseback riding, pack trips, and snowmobile trips is planned.

MINERSVILLE WATERSHED

A state boating park is located near Minersville Reservoir. Boat launching, sanitation and picnic facilities are provided. Minersville Reservoir use is expected to continue to grow due to the fact the State Park is expanding its facilities and subdivisions are being developed on private land along the shore for home sites. Building developments on Beaver Mountain are also expected to have an impact on Minersville Reservoir.

The Mineral Mountains provide spectacular scenery and are rich in mining lore. The Bureau of Land Management has developed limited picnic facilities at Rock Corrall, a natural rock enclosed amphitheater. A small stream of water and rugged topography combined with cottonwood tree groves makes Ranch Canyon an attractive area. Minersville has church and school-ground parks and the county has livestock showgrounds and a park area.

MILFORD WATERSHED

Milford has a unique character due to the influence of the railroad. It has a municipal swimming pool, parks, and a softball diamond. Streets are often blocked for sleigh riding and areas are flooded for ice skating in the winter.

RED CREEK WATERSHED

Red Creek Reservoir, situated in a scenic forested area, receives heavy recreation use by fishermen.

Parowan Gap, eight miles west of Parowan, contains interesting ancient Indian petroglyphs. The site has been fenced to curb vandalism. It is a partially developed recreation site with an interpretive sign and sanitary facilities.

COAL CREEK WATERSHED

The primary attraction is Cedar Breaks National Monument with its huge amphitheater eroded into the multicolored Wasatch geological formation. Facilities include a lodge, picnic and campground areas, and interpretive services.

A drive through Parowan and Cedar Canyons is a spectacular trip. National Forest developments include Cedar Canyon campground with a capacity of 190 people and Vermillion Castle campground with a capacity of 385 people. An archery range has been developed in Cedar Canyon. Also in Cedar Canyon is Wood's Ranch, a county picnic and outdoor activity area.

Picnic and sanitation facilities are provided at Yankee Meadows reservoir.

The Brian Head ski area is on private and National Forest lands. Adjacent private lands have been subdivided into about 500 summer-home lots, some partly developed.

Other private recreation development includes Co-op Basin near Parowan, containing approximately 2,000 acres of unimproved mountainous area. A reservoir was constructed several years ago for irrigation use. Fish have been planted,but trespass problems and irrigation water needs have prohibited its use as a regular fishery.

Municipal developments at Cedar City include a swimming pool, golf course, city park, little league ball fields, fair and rodeo grounds, and other school athletic facilities. Municipal developments at Parowan include a swimming pool, city park, and other facilities.

Indian mounds and petroglyphs are found near Summit and Parowan. The Summit Estates summerhome area is being developed east of Summit.

PINTO CREEK WATERSHED

Newcastle Reservoir is a popular fishing area. Summer and retirement homes are being developed along Meadow, Pinto and Little Pinto Creeks. Old Irontown is the site of early pioneer ironworks. Two historic towns, Holt and Hamblin, on the Old Spanish Trail, have been abandoned and only cemeteries remain.

SHOAL CREEK WATERSHED

Upper and Lower Enterprise Reservoirs provide scenic and fishing attractions. The reservoir dams are interesting examples of pioneer engineering and construction. A parking area and campground have been constructed. Honey Comb Rocks campground is located near the upper reservoir on Dixie National Forest. It is unique in construction and has modern facilities with a capacity of 110 people.

Undeveloped subdivisions are prevalent around Enterprise and Beryl Junction. Hebron Cemetery marks the remaining trace of a small pioneer village on Shoal Creek.

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

OUTDOOR RECREATION
NORTH PORTION
BEAVER RIVER BASIN
UTAH - NEVADA

June 1971

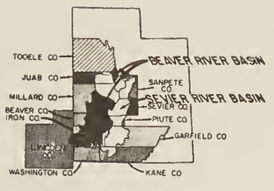
LOCATION MAP

LOCATION MAP OF SUB-BASINS

SCALE IN MILES 5 0 5 10

LEGEND

- Campground or Picnic Area
- Park or Rest Stop
- Points of Interest
- Observation and Interpretive Site
- Summer Home Residences
- Lodge or Resort
- Winter Sports
- Water Sports
- Public Swimming Pool
- Golf



LOCATION MAP

LOCATION MAP OF SUB-BASINS

LEGEND

- Campground or Picnic Area
- Park or Rest Stop
- Points of Interest
- Observation and Interpretive Site
- Summer Home Residences
- Lodge or Resort
- Winter Sports
- Water Sports
- Public Swimming Pool
- Golf

R. 71 E. R. 20 W. R. 19 W. R. 18 W. R. 17 W. R. 16 W. R. 15 W. R. 14 W. R. 13 W. R. 12 W. R. 11 W. R. 10 W. R. 9 W. R. 8 W. R. 7 W. R. 6 W.

T. 1 S. T. 2 S. T. 3 S. T. 29 S. T. 30 S. T. 31 S. T. 32 S. T. 33 S. T. 34 S. T. 35 S. T. 36 S. T. 37 S. T. 38 S.

NEVADA UTAH LINCOLN CO. IRON CO. WASHINGTON CO. BEAVER CO. PIUTE CO. GARFIELD CO.

114°00' 113°45' 113°30' 113°15' 113°00' 112°45' 112°30' 38°15' 38°00' 37°45' 37°30'

Modena Beryl Beryl Junction Enterprise Toble Bu. Three Pks. Iron Mtn. Staddard Mtn. Pinto Pinto Spring Harrison Pk. Big Mtn. Flat Top Mtn. Petroglyphs Pioneer Industrial Park Little Salt L. (Intermittent) Paragonah Cottonwood Mtn. Little Creek Pk. PAROWAN Summit Enoch CEDAR CITY Hamilton Fort Lone Tree Mtn. Quichapa L. (Intermittent) Newcastle

Old Spanish Trail Jefferson Hunt Historical Site Old Irontown Old Spanish Trail Fremont

2B2 2B1 3 4 5 6 1 2

DIXIE NATIONAL FOREST CEDAR BREAKS NAT'L MON.

LOWER ENTERPRISE RES. ENTERPRISE RES. NEWCASTLE RES. RED CREEK RES.

Shoal Cr. Meadow Cr. Hyatts Spring Big Hollow Wash Iron Wash Pinto Cr. Duncan Cr. Quichapa Cr. Right Fork Left Fork Shurtz Cr. Rush L. Johnson Cr. Jones Spr. Summit Cr. Bowery Cr. Parowan Cr. Cool Cr. Ashdown Cr. Willow Cr. Little Cr. Red Water Cr. Spring Wash Chalk Wash Long Lick Cr.

OUTDOOR RECREATION
SOUTH PORTION
BEAVER RIVER BASIN
UTAH - NEVADA

June 1971

5 0 5 10
SCALE IN MILES

PRESENT AND PROJECTED RECREATION USE

Total outdoor recreation in 1969 was estimated at 502,000 visitor-days. This compared to 284,000 visitor-days in 1959 represents an annual increase of seven percent. A visitor-day consists of a recreational activity for a twelve-hour period (twelve people for one hour or one person for a twelve-hour period).

PROJECTED RECREATION DEMAND

Projected recreation demand for 1980 by land ownership is 224,100 visitor-days on National Forests, 141,900 visitor-days at Cedar Breaks National Monument, 52,300 visitor-days on private lands, 224,100 visitor-days on public domain and 104,600 visitor-days on municipal, county, and state areas.

The procedure used to project recreation demand (Table 34) is similar to that developed by the Bureau of Outdoor Recreation and used in the "Recreation Appendix, Great Basin Region Comprehensive Framework Study, 1971." Demand was established by three categories--population zone, socioeconomic factors and an opportunity factor. Using this procedure, 95 percent of the resident demand is assumed to be satisfied entirely within the Basin. Recreation demand from the remaining part of the State was projected as follows: (1) population within 50 miles of the Basin, times 60 percent (percent satisfied in Beaver River Basin); plus (2) population between 50 and 150 miles of the Basin, times 30 percent (percent satisfied in Beaver River Basin); plus (3) state population more than 150 miles from the Basin, times 5 percent (percent satisfied in Beaver River Basin). The third population factor is tourist demand. For this factor, a "Standard Metropolitan Statistical Area" (SMSA), the LasVegas area in Nevada, was used. Two other factors, one developed for socioeconomic changes and the other as an opportunity factor were added to the computed population factors to arrive at the rate of increase for outdoor recreation.

Basin-wide present and projected recreation participation in 14 types of activity is estimated in Table 35. For example, although hunting is projected to increase from 69,360 visitor-days in 1965 to 116,810 visitor-days by 2020, it represents a decline from 17 percent of the total participation in 1965 to 7 percent by 2020. This indicates that change will occur between types of activities as well as the overall increase in recreation use.

TABLE 34.--Present and projected recreation demand, Beaver River Basin[a]

Items		Present 1965	Projected 1980	Projected 2020
(1)	Visitor Days Recreation Use	408,000[b]	747,000[c]	1,670,000[c]
(2)	Population, Beaver Basin	18,437	18,500	23,000
(3)	Pop. 0-50 miles from Basin	46,700	48,700	77,000
(4)	Pop. 50-150 miles from Basin	637,600	964,000	1,728,000
(5)	Remaining Utah Population	1,050,000	1,430,000	3,378,000
(6)	Pop. Las Vegas (SMSA)	345,200	556,000	2,057,000
(7)	Recreation Demand Index (RDI)[d]	306,575	435,300	858,000
	Population Growth Factor (PGF)[e]	1.00	1.42	2.80
	Socio-economic Factors	0.00	0.31	0.94
	Opportunity Factor	0.00	0.10	0.35
	Cumulative Factor	1.00	1.83	4.09

a From Recreation Appendix XII Great Basin Comprehensive Framework Study based on population increase within the Basin and use from the State of Utah and Las Vegas (SMSA).
b Estimated from field studies
c Visitor Days = Cumulative Factor x 1965 use
d RDI = (Item 2 x 95%) + (Item 3 x 60%) + (Item x 30%) + (Item 5 x 5%) + (Item 6 x 5%)
e PGF = RDI ÷ RDI for 1965

TABLE 35.--Present and projected outdoor recreation activity, Beaver River Basin, 1965, 1980, 2000 and 2020

Activity	Year 1965	1980	2020
		Visitor-days	
Driving	106,080	209,060	476,500
Picnicking	20,400	29,870	50,060
Fishing	61,200	101,600	133,500
Hunting	69,360	89,600	116,810
Swimming	8,160	14,930	33,370
Bicycling	2,080	7,300	40,250
Hiking	8,160	22,400	83,430
Boating	4,080	7,470	16,690
Golfing	12,240	32,260	150,180
Water skiing	400	800	2,400
Snow skiing	20,400	45,280	133,500
Horseback riding	16,840	37,330	66,750
Camping	73,440	133,810	331,910
Other	8,160	14,930	33.370
Total	408,000	746,640	1,668,720

The most rapidly growing segment of recreation demand is from out-of-state visitors. Utah State HIghway Department data indicate that in 1960, 38 percent of the passenger cars in average daily traffic near Cedar City were from out of state. By 1967 this had increased to 63 percent. In a study at a compground near Cedar City, license plates were checked on weekdays and weekends. On weekends, California cars comprised 34.1 percent, Nevada cars 27.6 percent and Utah cars 26.3 percent of the total. On weekdays California cars comprised 59.0 percent of the sample, Nevada cars 17.7 percent and Utah cars 12.8 percent.

Recreation on National Forests

Visitor-days of recreation use on National Forests by watersheds are shown in Table 36 for the period 1959 through 1965. The percentage of participation of recreation visitors by types of activity on National Forests is shown on Figure 7. A comparison of 1969 and 1965 data indicates increases in hiking and riding, use of commercial resorts, winter sports, and sightseeing; conversely, picnicking, fishing and hunting all decreased. Figure 8 indicates the participation of recreation visitors by types of site utilized. A comparison of 1969 and 1965 data indicates that the use of commercial developments, lakes and reservoirs, roads and trails and campgrounds all increased. Conversely, use of rivers and streams and undeveloped areas decreased. Based on this information, it appears that trends in preference are to activities associated with developments.

Recreation on public domain

Recreation use of public domain is increasing at a much more rapid rate than on other lands. Table 37 indicates the number of visits by recreation sites. No attempt was made to convert recreation "visits" to "visitor-days" as used elsewhere. Information used in projections indicate that 1965 use was 124,500 visitor-days and that this use is expected to increase to 224,000 visitor-days by 1980 and 509,200 visitor-days by 2020.

By far the most popular recreation site is the Little Sahara. Numbers of visitors to this area have increased phenomenally as indicated by Table 38. On Easter alone the number of visitors increased from a low of 5,000 in 1966 to 25,000 in 1968. Motorcycle races and dune buggy activities are very popular at this site.

TABLE 36.--Visitor days of recreation use on National Forests, Beaver River Basin, 1959-1965

Watershed		1959	1960	1961	1962	1963	1964	1965
2A-24	Chalk Creek	5,570	5,680	5,890	6,020	6,190	6,230	6,380
2A-25	Corn Creek	15,300	15,590	16,190	16,535	17,540	18,340	15,640
Fillmore		20,870	21,270	22,080	22,555	23,730	24,570	22,020
2B-1	Beaver	78,990	80,490	83,510	85,320	87,670	88,210	90,500
2B-2	Wildcat Creek	1,050	1,070	1,110	1,140	1,170	1,170	1,200
2B-5	Cove Creek	1,110	1,130	1,170	1,200	1,230	1,240	1,270
Beaver-Milford		81,150	82,690	85,790	87,660	90,070	90,620	92,970
2B1-1	Coal Creek	12,260	15,290	21,460	20,460	24,010	27,030	28,900
2B1-3	Red Creek	3,440	4,270	6,020	5,740	6,740	7,580	8,110
Cedar-Parowan		15,700	19,560	27,480	26,200	30,750	34,610	37,010
2B2-1	Pinto Creek	1,280	2,210	5,200	5,620	6,240	8,340	8,920
2B2-2	Shoal Creek	4,540	5,660	7,950	7,580	8,900	10,010	17,890
2B2-3	Beryl	340	430	600	570	670	760	810
Escalante Desert		6,160	8,300	13,750	13,770	15,810	19,110	27,620
Total River Basin		123,880	131,820	149,100	150,185	160,360	168,910	179,620

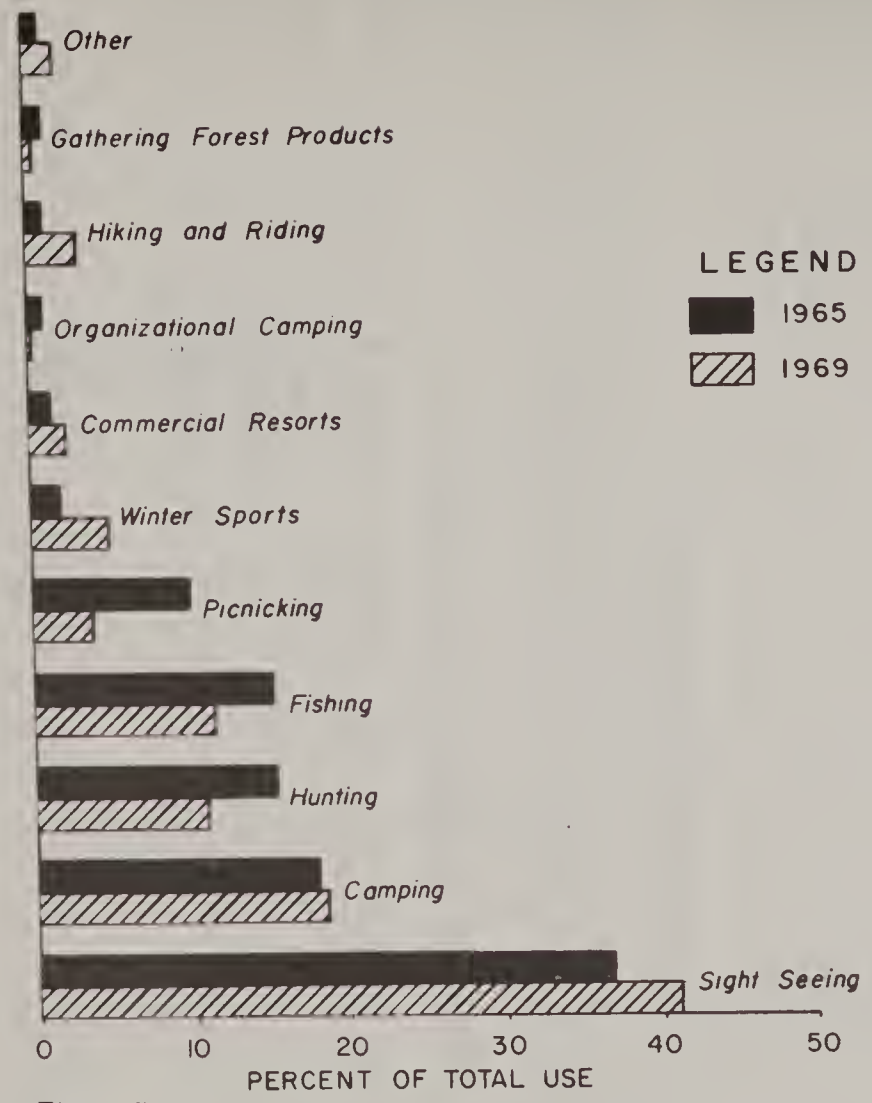


Figure 7:
Participation of recreation visitors by activity on National Forests, Beaver River Basin 1965 and 1969.

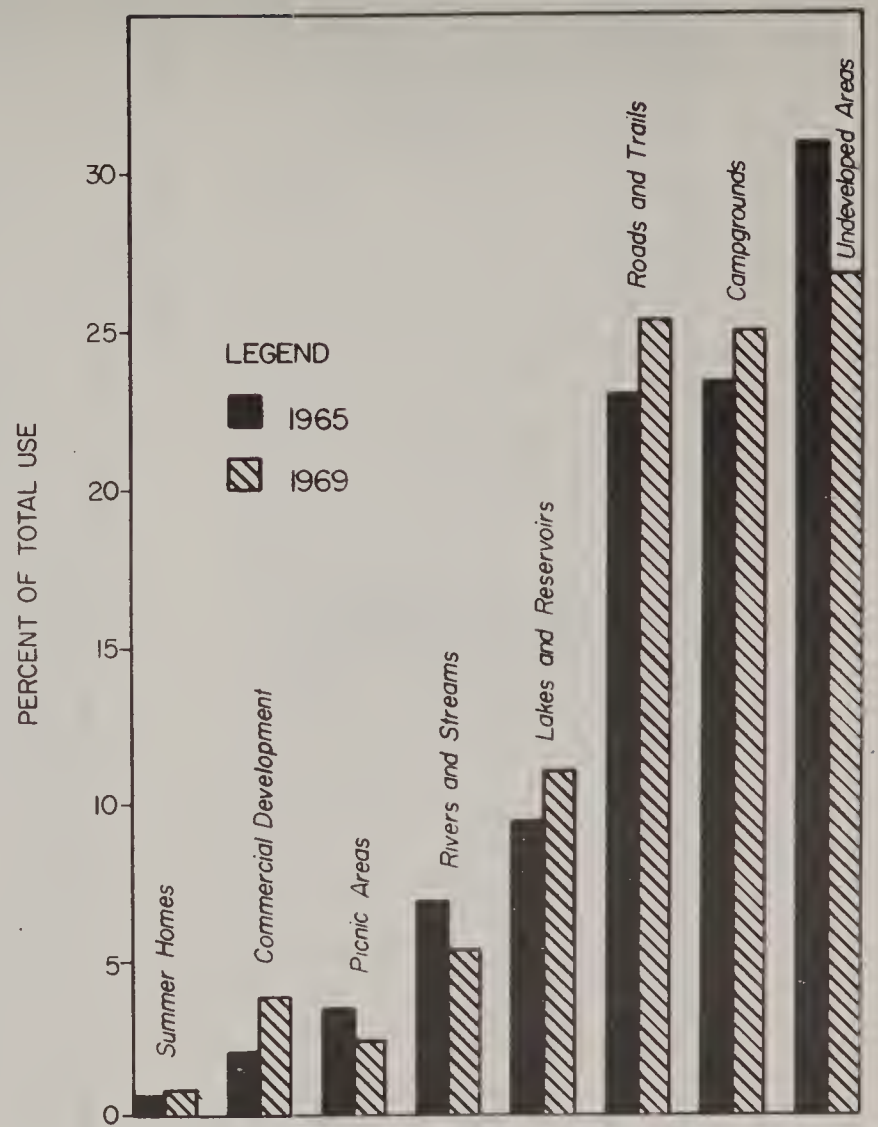


Figure 8: Participation of recreation visitors by site types on National Forests, Beaver River Basin 1965 and 1969.

TABLE 37.--Estimated recreation visits at public domain recreation sites, Beaver River Basin

Sites	Present visits 1970	Estimated number of visits by year 1980
Antelope Springs Area	2,000	5,000
Crystal Peak	500	800
Little Sahara	100,000	300,000
Paul Bunyon	1,200	2,500
Rock Corral	1,000	3,000
White Mountain	1,200	2,000
Minersville Reservoir	74,000[a]	150,000

[a]Half use on public domain.

TABLE 38.--Number of visitors to the Little Sahara recreation area, Beaver River Basin

YEAR	NUMBER OF VISITORS
1964	10,000
1965	12,000
1966	15,000
1967	35,000
1968	85,000
1969	90,000
1970	100,000

Recreation at Cedar Breaks National Monument

The 1965 recreation use at this area was 77,500 visitor-days. This use is expected to increase to 141,900 visitor-days in 1980 and to 317,000 visitor-days by 2020.

Recreation at Minersville Reservoir State Park

At Minersville Reservoir the Division of Parks & Recreation records show the use at the State Park as follows:

1970	Number of people
May	504
June	18,808
July	9,928
August	4,179
September	3,210
Total	36,629

State Park personnel estimate the use on the State Park area to be approximately 50 percent of the total for the entire reservoir.

Recreation on state, private, municipal and county areas

Outdoor recreation is difficult to define for these areas. There is very little information available and then decisions as to types of activity to be included add to the complexity. Should recreation use include children playing in their yard, a man mowing his lawn on a pleasant afternoon, a family taking a Sunday drive? The figures used in this river basin study are estimates only of participation in more formal recreation activities, such as golfing, swimming, and dude ranch activities and are considered conservative. Use in 1965 was estimated to be 29,000 visitor-days on private lands and 57,000 visitor-days on municipal, county and state areas. Projections are for 52,300 visitor-days by 1980 and 118,600 visitor-days by 2020 on private lands. On state, county and municipal areas these figures are 104,600 visitor-days by 1980 and 233,130 visitor-days by 2020.

FISHING AND HUNTING

About 30 percent of outdoor recreation is related to fishing and hunting activities. In 1969 this use was estimated at 151,000 visitor-days. By 1985, this is expected to increase to 212,000 visitor-days annually, but it will be a smaller proportion, about 24 percent, of total outdoor recreation.

State-wide information on fishing indicates that in 1968 fishermen caught an average of 31 fish during the year at a rate of about 0.88 fish per hour of fishing.[1] Fishing provided 82,000 man-days of recreation in 1969. This means that about 865,920 fish were harvested in the Beaver River Basin, or about 11 percent of the state harvest. By 1985, fishing activity is expected to increase to 121,000 man-days annually.

Fishing is popular at reservoirs constructed primarily for irrigation water management. Minersville Reservoir is the most popular fishing reservoir in the Basin. Much of the shoreline is privately owned, but about 50 percent is administered by the Bureau of Land Management. Stream fishing is more popular in the Beaver River Watershed than on any other streams in the Basin. Streams in this watershed are the only ones with sufficient stability and quality to support permanent fish life. Fish are planted on a put-and-take basis in other streams.

Hunting was estimated to provide 69,000 visitor-days of outdoor recreation activity in 1969 and this use is expected to increase to 91,000 visitor-days by 1985. This increase is much less than that predicted for other outdoor recreation activities. Deer, antelope, upland game birds, and rabbits provide the major hunting opportunities. Waterfowl and other game are limited, but do provide some hunting opportunities.

1/ "State-wide Fishery Management Survey, 1968, Fish Harvest Inventory." Publication No. 69-13, State of Utah Department of Natural Resources, Division of Fish and Game.

Deer

The area is noted for deer hunting opportunities and large deer herds. Deer are managed on a herd-unit basis. Harvest information shown in Figure 9 indicates trends in this activity. The percentage of out-of-state hunters in proportion to Utah hunters has increased from 40 percent in 1958 to 54 percent in 1967. Total deer-kill is in a downward trend. Key game ranges were overstocked causing resource damage, hence liberal hunting regulations were adopted to bring herd numbers in balance with habitat. Most managers feel this has been successful and that trends will perhaps now level off. Total deer killed exceeded the number of hunters in 1960 when 13,700 hunters killed 19,950 deer or 1.45 deer per hunter. At that time there were many multiple deer hunts. In 1964 the number of hunters and deer killed were nearly equal and by 1967 only 0.74 deer per hunter was killed.

In 1959 expenditure per nonresident for hunting and fishing was estimated to be $132.97[1/]. Based on this, 4,300 out-of-state deer hunters in 1967 spent $571,770.

Antelope

Antelope are the only other big game hunted. The number of hunters, kill, and percentage success for the three herd-units is shown in Table 39.

TABLE 39.--Antelope hunting averaged for 10 years of record, Beaver River Basin, 1958-1967

Hunting unit	Percentage of unit in Beaver River Basin	Hunters	Kill	Success
	Percent	Number	Number	Percent
West Desert #2	11	15	3	28
Southwest Desert #4	60	27	14	55
Cedar City #5	100	14	8	57
Total		56	25	45

1/ "The Economic Value of Fishing and Hunting in Utah", page 10, Bureau of Economic and Business Research, University of Utah, Salt Lake City, Utah, 1961.

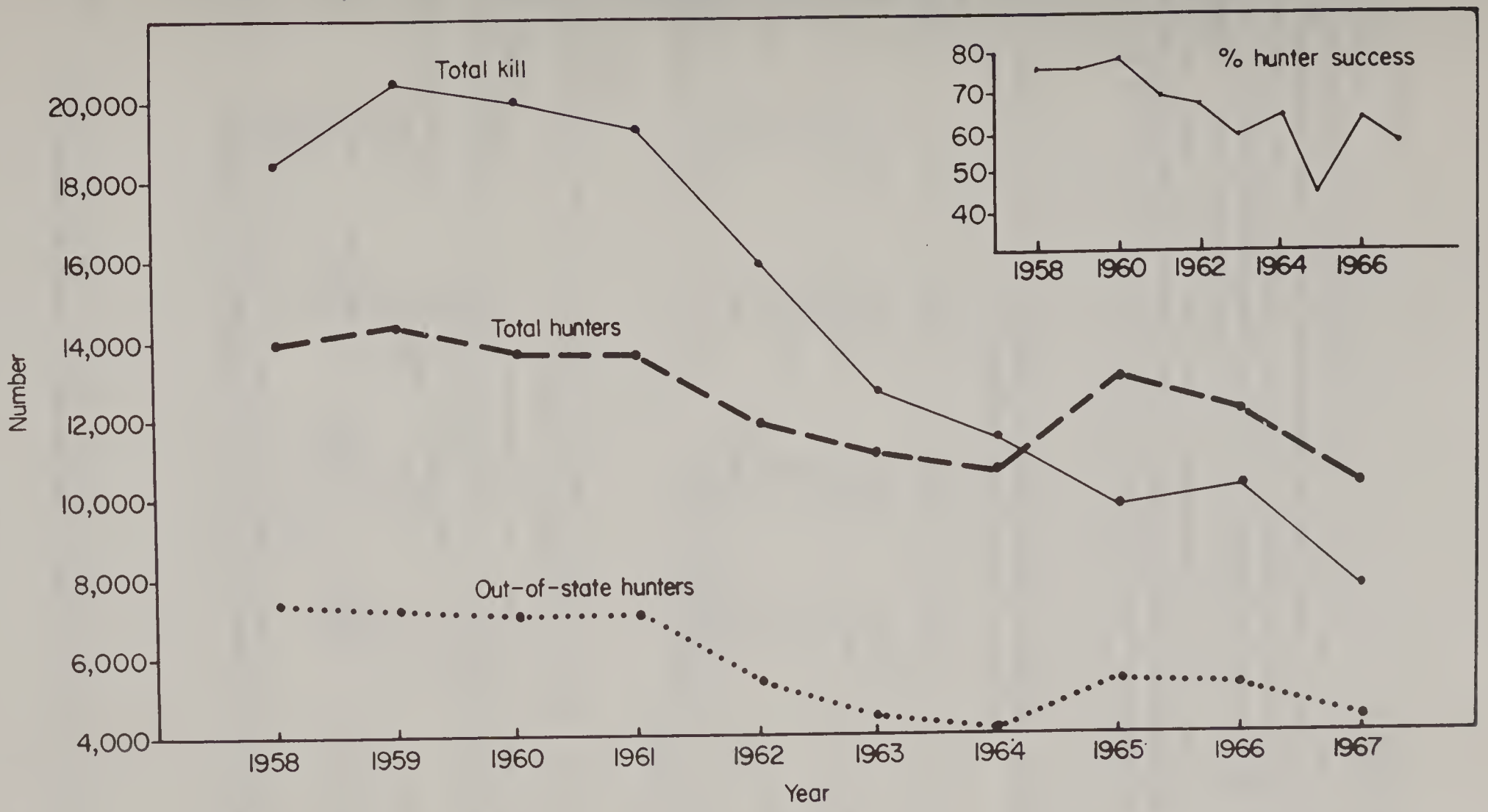


Figure 9:
Total deer killed, number of hunters, and hunter success, Beaver River Basin

Source: "Utah Big Game Investigations and Management Recommendations" Annual Report, 1958 through 1967, published by Utah Division of Fish and Game, Department of Natural Resources.

Upland Game Birds[1/]

Upland game birds in the Basin include pheasants, mourning doves, chukar partridge, sage grouse, forest grouse and quail. The number of hunters afield and the total harvest for each species is tabulated for 1964 through 1967 in Tables 40 and 41. These data include entire counties, therefore, some areas outside the Basin are included. Millard County had 71 percent of the pheasants, 61 percent of the doves, and 99 percent of the chukars. Beaver County had 86 percent of the sage grouse. Iron County had 53 percent of the forest grouse and 51 percent of the quail.

TABLE 40.--Number of game bird hunters for Beaver, Iron and Millard Counties, Beaver River Basin

	1964	1965	1966	1967	Average
Pheasants	6,026	4,527	4,289	3,664	4,626
Mourning Doves	653	861	1,253	1,532	1,075
Chukars	96	212	291	389	247
Sage Grouse	113	203	118	41	119
Forest Grouse	77	96	120	238	132
Quail	142	158	142	108	138
Total	7,107	6,057	6,213	5,972	6,337

TABLE 41.--Number of game birds harvested for Beaver, Iron and Millard Counties, Beaver River Basin

	1964	1965	1966	1967	Average
Pheasants	12,552	11,567	11,989	12,722	12,206
Mourning Doves	8,978	10,598	20,226	19,214	14,753
Chukars	343	674	1,024	288	582
Sage Grouse	241	253	108	41	160
Forest Grouse	32	0	65	430	132
Quail	0	454	86	410	237
Total	22,146	23,546	33,498	33,105	28,071

1/ "Utah Upland Game Bird Harvest", annual reports, 1964-1967, Utah State Division of Fish and Game, Department of Natural Resources.

Pheasants: The number participating in pheasant hunting has decreased from 6,026 hunters in 1964 to 3,664 hunters in 1967. This may be due partly to increased posting and other restrictions on hunting. The number of pheasants harvested during this four-year period has remained almost constant, indicating that the harvest per hunter has increased. Average number of hunters per year, in the four-year period is 4,626 making pheasant hunting about four times as popular as hunting any other upland game bird.

Mourning Doves: The popularity of mourning dove hunting has increased in about the same proportion that pheasant hunting has declined (Figure 10). In 1964, there were 653 mourning dove hunters, and 1,532 in 1967. The average per year for the four years is 1,075 hunters, making this the second most popular game bird. Numbers of mourning doves harvested increased rapidly from 8,979 in 1964 to 20,266 in 1966 and then declined slightly to 19,214 in 1967.

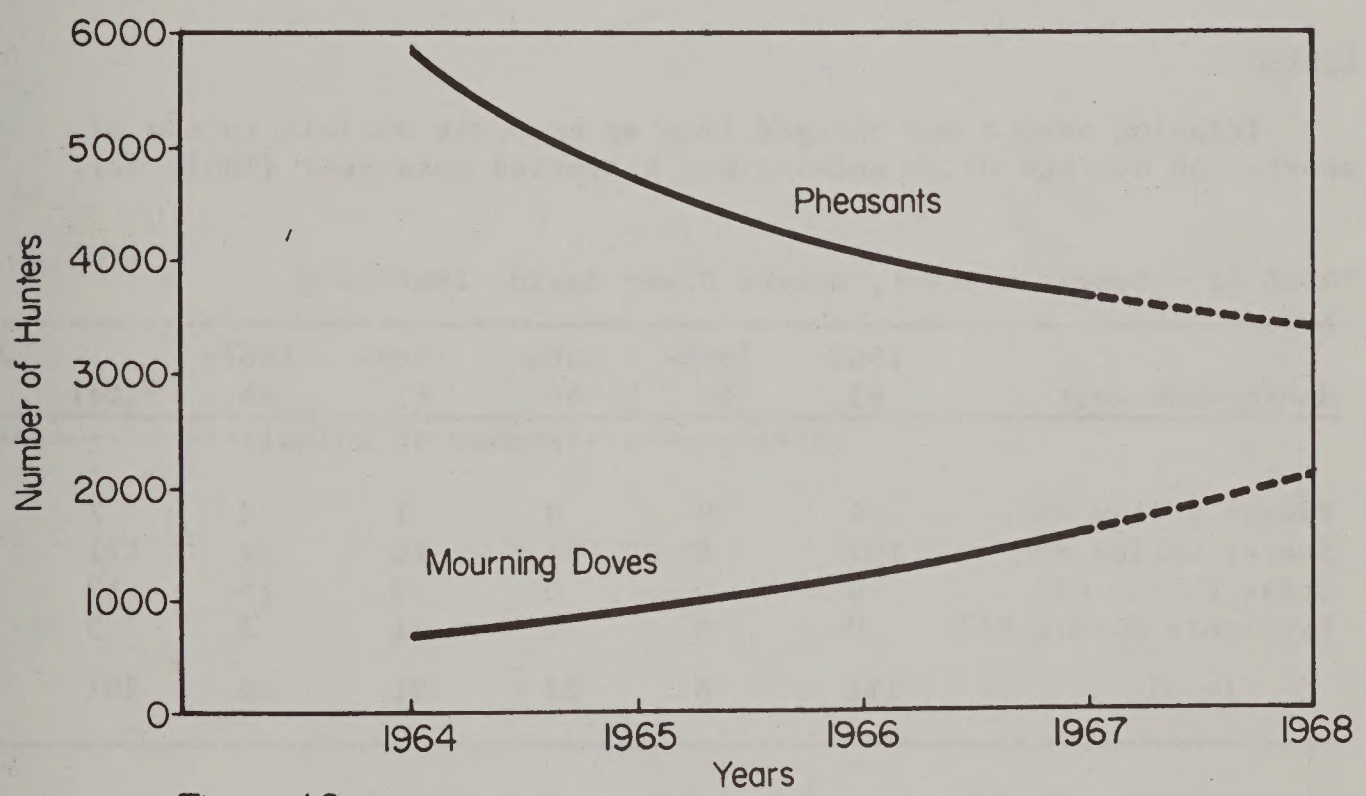


Figure 10:
Pheasant and Mourning Dove Hunting, Beaver River Basin

Chukars: Chukar hunting was limited with an estimated 247 hunters each year. The annual harvest averaged 582 birds. Chukars were recently introduced, anticipating they would adapt to arid conditions and increase opportunities for upland bird hunting.

Sage Grouse: Sage grouse populations have steadily declined since Utah was settled. Domestic livestock grazing, cultivation and development have resulted in destruction of essential sage grouse habitat. In the four years evaluated, an average of 119 hunters harvested 160 birds.

Forest Grouse: Ruffed grouse is the principal forest grouse. They inhabit brushy creek bottoms and coniferous forested areas at higher elevations. An average of 132 hunters harvest an average of 132 birds annually.

Quail: Gambel quail occupy habitat similar to pheasants and are often hunted in connection with these larger birds. An average of 138 hunters shoot 237 birds annually.

Beaver

Trapping beaver has changed from an economic pursuit to one of sport. An average of 50 animals are harvested each year (Table 42).

TABLE 42.--Beaver harvest, Beaver River Basin, 1962-1968

Management unit	1962-63	1964-65	1965-66	1966-67	1967-68	Total	Average
	Number of animals						
Pavant Valley #34	4	0	0	1	2	7	2
Beaver Valley #35	107	8	21	16	19	171	43
Cedar Valley #36	0	0	0	3	15	18	4
Escalante Desert #37	0	0	1	1	3	5	1
Total	111	8	22	21	29	201	50

Source: "Utah Furbearers Annual Report", 1962-1967. Published by Utah Division of Fish and Game, Department of Natural Resources.